DOE F 1325.8
(8-89)
EFG (07-90)

United States Government **Department of Energy**

memorandum

DATE: April 14, 1992

REPLY TO ATTN OF: EH-25

SUBJECT: Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI), Fermilab Main Injector Project, Fermi National Accelerator Laboratory, Batavia, Illinois

TO: William Happer
Director
Office of Energy Research

This is in response to your January 13, 1992, memorandum which requested approval of the EA (DOE/EA-0543) for the subject project and publication of the proposed FONSI in the Federal Register for a 30-day public comment period. A revised EA, based on technical comments provided by the Office of the General Counsel and the Office of NEPA Oversight, was submitted by the Energy Research NEPA Compliance Officer on March 20, 1992. We note that no public comments were received in response to a Notice of Floodplain and Wetland Involvement published in the Federal Register on June 11, 1991. Further, we have been advised by the Energy Research NEPA Compliance Officer that the State of Illinois is willing to waive its opportunity to review the EA prior to approval and will conduct its review of the EA in concert with public review of the proposed FONSI.

Therefore, based on staff review and after consultation with the Office of General Counsel, I have determined that the EA is adequate for publication and distribution, subject to the incorporation of the changes noted on the attached marked-up copy. I have preliminarily determined that there are no significant impacts and I have signed the attached proposed FONSI. Since the proposed action is, or is closely similar to an action which normally requires the preparation of an environmental impact statement (EIS), the proposed FONSI should be made available for public review for 30 days prior to a final decision on the need for an EIS. After the close of the 30-day public comment period, comments received on the proposed FONSI will be considered prior to issuing a final determination on the need for an EIS.

We are reviewing the draft mitigation action plan and will complete our review after consideration of any public comments received during the 30-day public review period.

Paul L. Ziemer, Ph.D.
Assistant Secretary
Environment, Safety and Health

Attachments

cc: James Farley, ER-8.2
NEPA Compliance Officer

U.S. Department of Energy

Proposed Finding of No Significant Impact

Fermilab Main Injector

Fermi National Accelerator Laboratory

AGENCY: U.S. Department of Energy

ACTION: Proposed Finding of No Significant Impact (FONSI)

SUMMARY: The Department of Energy (DOE) has prepared an Environmental Assessment (EA), DOE/EA-0543, for the proposed construction and operation of the Fermilab Main Injector (FMI) accelerator at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. The accelerator would be housed in a ring enclosure having a circumference of about two miles. The FMI complex would include the necessary beamlines to connect to existing facilities, service buildings, an assembly building, and a new 345 kV substation with connecting electric power lines. The proposed action would include cooling ponds, access roads, service utilities, and landscaping. The FMI construction would affect 135 acres of the 6800-acre Fermilab site. Completion of the proposed action would make it possible to realize the full scientific potential of Fermilab's high energy physics well into the 21st century.

Based on the analysis in the EA, DOE believes that the proposed action would not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969, 42 U.S.C. 4321 et seq, that would require the preparation of an Environmental Impact Statement (EIS). Therefore, the DOE proposes to issue a Finding of No Significant Impact (FONSI). The proposed FONSI and the EA are being made available for public comment for a period of 30 days following the date of this notice. Comments postmarked within the

30-day public comment period will be considered by DOE prior to a final determination whether to issue a FONSI or to prepare an environmental impact statement for the proposed FMI project.

DESCRIPTION OF THE PROPOSED ACTION:

The proposed action consists of the construction and operation at Fermilab of a 150 GeV Main Injector accelerator and associated facilities, including beamlines to connect to the existing Tevatron, Antiproton Source, and Fixed Target experimental areas. It would replace the 20-year-old Main Ring accelerator that is housed in the 4-mile circumference Tevatron ring enclosure. Many of the components of the Main Ring accelerator would be reutilized in the FMI.

Luminosity is a term used to measure the rate of interactions of counter-rotating beams of particles at their collision areas. The primary goal of the proposed project is to increase the luminosity of antiproton-proton interactions at the two existing Fermilab collider detector facilities by as much as five-fold. It will also increase the intensity of protons for fixed target Tevatron operations by about three-fold. Specifically provided for in the scope of the proposed project are:

a. Construction of the ring enclosure, service buildings, utilities, and fabrication of new technical components, including dipole magnets and power supplies.

b. Construction of beamline enclosures, service buildings, utilities, and technical components required to implement an 8 GeV Booster-to-FMI beam line, 150 GeV proton and antiproton FMI-to-Tevatron beam transfer lines, and a 120 GeV FMI-to-Antiproton Production Target beamline.

c. Fabrication of technical components required to implement the delivery of 120 GeV beam from the FMI to the Fixed Target research areas.

d. Modifications to the F-Zero section of the Tevatron which are required for installation of the 150 GeV proton and antiproton transfer lines.

e. Construction of an assembly building to house the fabrication, assembly and quality assurance of technical components.

f. Construction of a new 345 Kv substation and approximately 2½ miles of power lines for delivery of electric power to the FMI site.

ALTERNATIVES: Two alternatives to the proposed action are considered in the EA: (1) no action, and (2) construction at other sites within Fermilab. Taking no action would mean not constructing the FMI accelerator, and continuing operations at Fermilab under current management practices. The no action alternative would result in no alteration of wetlands or the floodplain of Indian Creek. Because of technical constraints associated with the design of beamlines, the FMI must be sited at one of six straight sections of the Tevatron. Siting the FMI along straight sections of the Tevatron would involve the disturbance of approximately 27 acres of wetlands, a site listed in National Register of Historic Places, and almost all of the reconstructed native prairie. The second alternative would be technologically and environmentally unacceptable.

ENVIRONMENTAL IMPACTS: The EA analyzes the impacts of the construction and operation of the FMI. DOE had developed a draft Mitigation Action Plan (MAP) for implementation of mitigative measures designed to minimize the significance of potential environmental impact. The draft MAP which is included as Appendix C of the EA, will be revised, as appropriate, based on public comments. The following is a summary of the environmental consequences of the proposed action.

Impacts to Floodplain/Wetlands: The construction of the FMI would require permanently filling about six acres of existing wetlands. The FMI has been designed to minimize the impact on wetlands. The plan is to construct about eight and one-half acres of new wetlands to offset the filled wetlands. On August 13, 1991, the U.S. Army Corps of Engineers (COE) issued DOE a permit pursuant to Section 404 of the Clean Water Act to fill the wetlands. On June 4, 1991, the Illinois Environmental Protection Agency issued a water quality certification pursuant to Section 401 of the Clean Water Act. The third agency involved in the joint permit application, the Illinois Department of Transportation/Division of Water Resources (IDOT/DWR), has reviewed the proposed alteration of Indian Creek and its floodplain, and has given preliminary approval. The IDOT/DWR must approve the final construction drawings before ground breaking can commence. A Floodplain/Wetlands Assessment, incorporated in the EA, analyzes the proposed action's effect on the wetlands, and the compensatory measures that would be taken. The Floodplain/Wetlands Assessment analyzes the disturbance to Indian Creek's existing 100-year floodplain and the mitigation measures that would be taken to compensate for the disturbance. No negative impacts due to flooding are expected from construction of the FMI. In accordance with the DOE Regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR Part 1022), a Notice of Floodplain and Wetland Involvement was published in the Federal Register on June 11, 1991 (56 FR 26806); no comments were received.

Impacts to Ecology: Experts in birds, plants, insects, amphibians, reptiles and mammals have conducted field surveys in the FMI construction area. Suitable habitat and the presence or absence of the listed species have been recorded, and the consultants' reports are referenced in the EA. No threatened or endangered species would be affected by FMI construction or operation. As is discussed in the EA, particular attention has been paid to a great blue heron rookery, inside the proposed FMI, which was used until the summer of 1990. In 1991, the herons did not return to this area but used another nesting

area on the Fermilab site. An ornithologist has formulated recommendations concerning protection of the rookery inside the proposed FMI and other migratory fowl in the area. The recommendations (including a plan for construction date restrictions) will be followed by DOE as part of the proposed action if the herons return to the rookery inside the FMI.

Radiation Impacts: Operation of the proposed FMI would result in insignificant amounts of radioactive emissions to the air and releases to soils. Fermilab's radionuclide emissions to the atmosphere after the FMI becomes operational would result in a dose to a hypothetical individual at the site boundary of 0.33 mrem/yr under typical operating conditions. The maximum dose at the site boundary from the current Tevatron operation with the Main Ring accelerator is estimated to be 0.029 mrem/yr. Even with conditions maximized, the cumulative emissions for Fermilab with the FMI would result in a dose to a hypothetical individual at the site boundary of 1.0 mrem/yr. Thus, Fermilab's radionuclide emissions as a result of FMI operations would result in a dose to a member of the public of less than one-tenth of the U.S. EPA's standard of 10 mrem/yr for airborne radionuclide emissions from DOE facilities.

The proposed FMI has been designed to ensure ample protection to Fermilab employees and to the public from penetrating radiation. Appropriate shielding would be used to prevent any significant increase over historical levels. It is anticipated that FMI operations would not result in detectable levels of accelerator-produced radionuclides in surface waters, sediments, or groundwater. No significant off-site or on-site impact from an accident is expected at FMI.

Cumulative Impacts: No significant cumulative or long-term environmental effects are expected to result from the proposed action. The power consumption of Fermilab would be increased by 25% over that consumed in fiscal year 1990 but could be met by existing capacity.

PROPOSED DETERMINATION:

Based on the analyses in the EA, the DOE believes that the proposed construction and operation of the FMI at the Fermilab does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of the National Environmental Policy Act of 1969. Therefore, the DOE proposes to issue a Finding of No Significant Impact (FONSI).

PUBLIC AVAILABILITY: The EA and the proposed FONSI are being made available for public review for a period of 30 days following the date of this Notice. Following completion of the public review period, the DOE will consider comments received prior to making a determination on whether to issue a FONSI or to prepare an environmental impact statement for the proposed FMI project. Comments should be addressed to Mr. Mravca at the following address and postmarked no later than 30 days after publication of this Notice to ensure consideration. Comments postmarked after that date will be considered to the extent practicable.

Copies of this EA (DOE/EA-0543) are available from:

Andrew E. Mravca, Manager
Batavia Area Office
U.S. Department of Energy
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(708) 840-3281

For further information regarding the DOE NEPA process, contact:

Carol M. Borgstrom, Director
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U.S. Department of Energy
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Washington, D.C. 20585
(202) 586-4600 or (800) 472-2756

Issued in Washington, D.C., this 17th day of April, 1992.

Paul L. Ziemer, Ph.D.
Assistant Secretary
Environment, Safety and Health

DOE/EA-0543

ENVIRONMENTAL ASSESSMENT

PROPOSED FERMILAB UPGRADE

MAIN INJECTOR PROJECT

April 1992

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

AGS	Alternating Gradient Synchrotron
ALARA	As Low As Reasonably Achievable (radiation exposures)
ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
BOD_5	Biochemical Oxygen Demand (5 day test)
CECO	Commonwealth Edison Company
CERN	European Laboratory for Particle Physics
CFR	Code of Federal Regulations
CIP	Cast-in-Place
cm	centimeter
COE	U.S. Army Corps of Engineers
c.y.	cubic yards
dB	decibel
DO	Disolved Oxygen (Table 3.8.2)
DOE	(U.S.) Department of Energy
DOT	(U.S.) Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMF	Electro Magnetic Fields
ESS	Electronic Switching System
^{11}C	Carbon Eleven Isotope
EPA	Environmental Protection Agency
FMI	Fermilab Main Injector
ft/yr	Feet per year
^{40}Ar	Argon 40 Isotope
^{41}Ar	Argon 41 Isotope
FTS	Federal Telephone System
FX	Foreign Exchange
gpd	gallons per day
HEPAP	High Energy Physics Advisory Panel
IB-5	Industrial Building No. 5
IBT	Illinois Bell Telephone
ICW	Industrial Cold Water
IDOC	Illinois Department of Conservation
IDOT/DWR	Illinois Department of Transportation/Division of Water Resources
IEPA	Illinois Environmental Protection Agency
ILM	Integrated Lakes Management
ISHPO	Illinois State Historic Preservation Officer
kV	kilovolt
KMS	Kautz Road Master Substation
LCW	Low Conductivity Water
MARS	Midwest Archaeological Services, Inc.
mg	milligram
MGD	Million Gallon Day
mrem/yr	milli rem per year
MVA	megavolt ampere
MW	megawatt
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NRHP	National Registry of Historic Places
^{137}Cs	Cesium 137 Isotope
pCi/ml	pico Curies per millimeter
PA	Programmatic Agreement
PCBs	Undesirable component of transformer oil (Polychlorinated Biphenyls)
PPA	Pennsylvania/Princeton Accelerator
RCRA	Resource Conservation and Recovery Act
R&D	Research and Development
rem/yr	rem per year
SSC	Superconducting Super Collider
TSCA	Toxic Substances Control Act
^{3}H	Tritium
^{13}N	Nitrogen 13 isotope
^{22}Na	Sodium 22 isotope
^{38}Cl	Chlorine 38 isotope
^{39}Cl	Chlorine 39 isotope
U.S. EPA	U.S Environmental Protection Agency

CHAPTER 1

1.1 INTRODUCTION

The U.S. Department of Energy (DOE) proposes to construct and operate a "Fermilab Main Injector" (FMI), a 150 GeV proton injector accelerator, at the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. The purpose and need for this action are given in Section 1.2 of this Environmental Assessment (EA). A description of the proposed FMI and construction activities are given in Chapter 2. The proposed FMI would be housed in an underground tunnel with a circumference of approximately 2.1 miles (3.4 kilometers), and the construction would affect approximately 135 acres of the 6,800 acre Fermilab site.

Fermilab is a federal research laboratory owned and supported by DOE and operated by Universities Research Association, Inc., a consortium of 72 universities. The Fermilab complex includes a village, an office center, research centers, underground structures and equipment for performing physics experiments. Figure 1.1.1 is an aerial photograph of Fermilab on which the proposed FMI ring has been superimposed.

The high energy physics program at Fermilab investigates the structure of matter using the collision of particles to create new matter. These collisions take place in the Tevatron tunnel and in the fixed target experimental areas. Figure 1.1.2 is a schematic view of the proposed FMI connections to the Tevatron complex and fixed target experimental areas. The proposed FMI would provide particles for injection into the Tevatron and for delivery to the existing fixed target experimental areas during collider operations. The proposed FMI would permit simultaneous operation of Fermilab's collider and fixed target programs, thereby making possible an increase in Fermilab's physics output.

1.2 PURPOSE AND NEED FOR PROPOSED ACTION

The purpose of the proposed FMI is to construct and bring into operation a new 150 GeV proton injector accelerator. This addition to Fermilab's Tevatron would enable scientists to penetrate ever more deeply into the subatomic world through the detection of the super massive particles that can be created when a proton and antiproton collide head-on. The conversion of energy into matter in these collisions makes it possible to create particles that existed only an instant after the beginning of time. The proposed FMI would significantly extend the scientific reach of the Tevatron, the world's first superconducting accelerator and highest energy proton-antiproton collider. After 1992 when CERN terminates its proton-antiproton collider program, the Tevatron will be the world's only proton-antiproton collider. Tevatron experiments would continue even in the absence of the FMI; however, with considerably reduced capabilities. It should be noted that the proposed FMI would produce an improved proton accelerator that would be a portion of the complex of sequential accelerators that together are the Tevatron.[1]

The proposed FMI is needed to find the top quark, one of the missing links of particle physics. Its sister, the bottom quark, was discovered at Fermilab in 1977. Discovery of the top quark is beyond the reach of any existing high energy laboratory.

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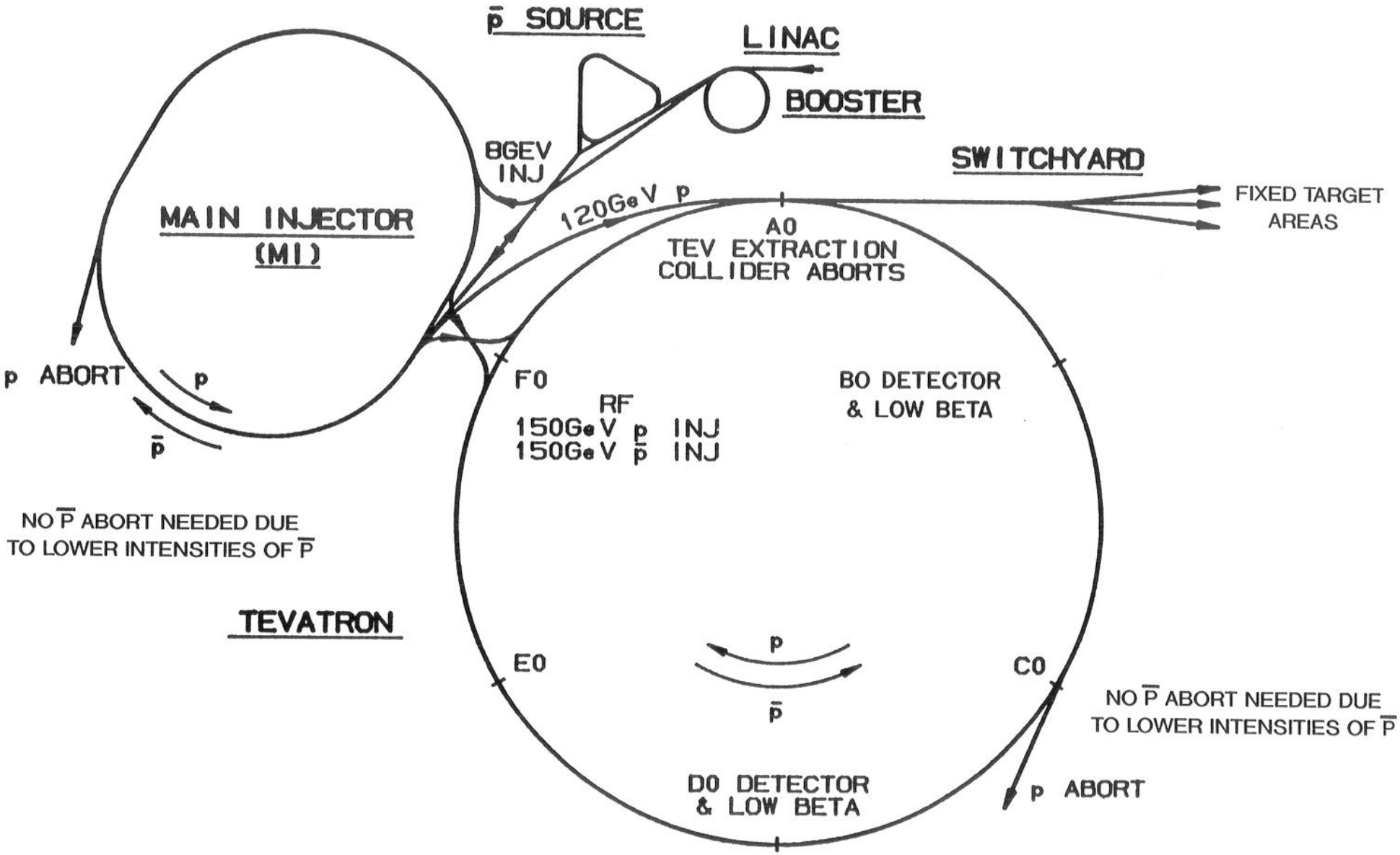
[1]The Tevatron accelerator derives its name from trillion electron volts, a measure of the energy of the particles it accelerates. The Tevatron currently operates at 800 GeV (Giga electron volts) for fixed target operations and 900 GeV for collider operation.

FIGURE 1.1.1 SITE PLAN
SCALE: 1" = 800 METERS



Schematic view of Main Injector connections to Booster, Antiproton Source, Tevatron, and Switchyard.

FIGURE 1.1.2 FERMILAB TEVATRON ACCELERATOR
WITH MAIN INJECTOR

Scientists working at Fermilab are convinced that Fermilab's Tevatron upgraded with the proposed FMI would enable them to discover the top quark. The current understanding of the structure of matter predicts that the top quark must have a mass between 90 and 250 times the mass of the proton, the range made accessible by construction of the proposed FMI. If the top quark is not discovered within that range, the result would reveal a deep mystery in our current understanding of fundamental particles.

The FMI would make it possible to increase the scientific potential of the Tevatron for at least the next 20 years at a small fraction of the cost that was required to build the Tevatron complex. It would provide both an important testing ground for experimental techniques and a vital training ground for scientists who will be crucial to the success of experiments at the Superconducting Super Collider (SSC), America's next generation particle accelerator. The proposed FMI would also allow Fermilab to continue making important contributions to high energy physics beyond the start of the next century when the SSC begins operation.

When the SSC becomes operational some time after the year 2000, it will not make Fermilab obsolete, since many experiments that could be conducted at Fermilab would be inappropriate[2] for the SSC. With the construction of the proposed FMI, Fermilab would serve as a vital tool for scientists using intense beams like those planned for the SSC. This is critical to the success of experiments at the SSC.

The main thrust of the DOE's high energy physics program during the next several years is to understand the basis of the Standard Model of subatomic matter and what lies beyond it. It is essential to exploit the present frontier facilities such as the Tevatron. The present physics program has high discovery potential through searches for new phenomena at this highest energy machine.

The Fermilab superconducting Tevatron collider is and will remain for many years the world's highest-energy particle accelerator, with unique discovery potential. Collider investigations at this facility are naturally complemented by various key fixed-target experiments at Fermilab.

It is necessary to upgrade the capabilities of this high energy facility to enable forefront physics goals to be pursued. The FMI is needed in order to accomplish this. The FMI facility description is given in 2.1.1.

In order for Fermilab to maintain a vital long-range colliding-beam physics program, it is necessary that the luminosity[3] increase significantly each experimental operating period so that higher energy constituent collisions can be explored. The cumulative integrated luminosity should roughly double each operating period in order that new physics

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[2]As has always been the case, the pursuit of our understanding of physical phenomena divides into branches where the experiments are carried out at the appropriate energy; thusly, the SSC, which is designed for 20 TeV on 20 TeV collisions, is not suitable for experiments in the energy range of the Tevatron. This is why the Brookhaven National Laboratory (BNL) 30 GeV Alternating Gradient Synchrotron (AGS) accelerator still operates even more than 20 years after Fermilab physics started.

[3]Luminosity is a technical term used to measure how frequently particles collide. The concept is similar to the brightness of optical images obtained with binoculars. That is, a 10 power, 25 mm field lens binocular gives a less bright image than a 10 power, 50 mm field lens binocular; however, the size of the images are identical. With greater luminosity more events are measured in the collider detectors per hour of operation.

can be explored. This can be accomplished by luminosity increases or by longer operating periods.

In October 1989, the Director of the Office of Energy Research of the DOE asked the High Energy Physics Advisory Panel (HEPAP) to offer guidance with regard to "the relative importance and appropriate balance: (a) between operations and major upgrades at a given laboratory, and (b) among the proposed major upgrades and new facilities at the various laboratories." In April 1990, after meetings at all of the high energy physics laboratories and after receiving input from the high energy physics community, the sub-panel of HEPAP issued its report (Report of the HEPAP Sub-panel on the U.S. High Energy Physics Research Program for the 1990s). HEPAP unanimously endorsed this report at a meeting on April 23 and 24, 1990.

The report says: "The Sub-panel (1) strongly recommends the immediate commencement and speedy completion of construction of the Tevatron Main Injector at Fermilab... (2) The Sub-panel assigns highest priority to the first of its recommendations. The increased luminosity provided by the Tevatron Main Injector will place Fermilab in an excellent position to discover the top quark. The necessary technology for this project is firmly in hand, and a carefully considered and reliable design exists."

On the basis of this recommendation, the FMI was included in the President's FY92 budget which became law on August 17, 1991. At a meeting on October 28 and 29, 1991, HEPAP reaffirmed the priority it had given the Main Injector. The President's budget for FY93, which was submitted to Congress in January 1992, contained $30 million for the proposed project for FY93 in addition to the $15 million appropriated for the project in FY92. HEPAP has a special panel studying the years beyond 1993 in order to recommend a set of priorities that would yield the best physics program within existing fiscal constraints. This panel is expected to report to HEPAP in April 1992 after which HEPAP is expected to make a recommendation to DOE.

The Fermilab's Tevatron is presently running with a peak luminosity of 2×10^{30}. Fermilab's primary goal is to increase the luminosity at the collider detectors by at least a factor of 30. Another goal is to increase the intensity of protons for fixed target operation by a factor of 3. Increasing the luminosity is intimately related to increasing the number of antiprotons available. Measures are currently being taken at Fermilab to increase the antiproton production rate by a factor of about 3. However, following implementation of these improvements the 20-year-old Main Ring accelerator will remain the primary bottleneck restricting further production rate improvements. All of the accelerators that are involved in the production of antiprotons have significantly larger apertures than the Main Ring accelerator. Therefore, the Main Ring accelerator is the bottleneck in antiproton production. The proposed FMI would remove this bottleneck, since it would replace the Main Ring accelerator in all of its functions, and its aperture would be matched to the other accelerators, thereby assuring the achievement of a luminosity of 5×10^{31}.

CHAPTER 2

THE PROPOSED ACTION AND ALTERNATIVES

2.1 DESCRIPTION OF THE FMI (PROPOSED ACTION)

2.1.1 FMI Facility Description

The proposed action is the design, construction, and operation of a new FMI accelerator, and the subsequent shutdown of the Main Ring accelerator. The proposed FMI would be a 150 GeV accelerator with a circumference of about one-half that of the existing Main Ring accelerator and would be situated tangent to the Tevatron at the F0 straight section[1] in the southwest corner of the Fermilab site. The proposed FMI would be constructed using newly designed (iron and copper) dipole magnets. These magnets would be assembled on the Fermilab site in a proposed new building, Assembly Building No. 5 (AB-5), which is discussed later in this section. New magnets would be built because of the need for improved field quality, aperture, and reliability. With the major exception of the dipoles, most existing components of the Main Ring would be used in the FMI.

Fermilab's 20-year-old Main Ring accelerator would be shut down when the first hardware that would be reused became required. The tunnel containing the Main Ring accelerator and Tevatron is shown in the photograph (Figure 2.1.1.1); the Main Ring magnets are colored red and blue; the Tevatron magnets are located below the Main Ring.

The proposed FMI, whose surface features are shown in Figure 2.1.1.2, would serve a number of purposes. It would function as a bi-directional injector into the Tevatron. This means it would be near and approximately tangent to the Tevatron. Secondly, it would receive 8 GeV protons from the Booster and 8 GeV antiprotons from the Antiproton Source. It would also provide 120 GeV protons to the antiproton target. Finally, the new accelerator would provide a 120 GeV beam to the present Fermilab fixed target facility hardware.

The new tunnel would be an oval-shaped, below grade structure, approximately 10,900' long, with a 10' wide by 8' high cross-section. The floor of the tunnel would be level and at an elevation of 713'6" above sea level, 18' to 33' below existing grade. The FMI ring equipment would be positioned 2' above the floor and 1'9" to 2' from the outer wall. Earth shielding berms over the FMI tunnel would provide the required 24.5' of earth equivalent shielding.

The proposed FMI ring tunnel would be constructed on a reinforced concrete cast-in-place (CIP) base slab. Approximately 9,900' of the ring would be built with precast concrete inverted "U" sections that would be welded to the CIP base slab. Nearly 26,000' of this type of precast have been economically installed at Fermilab during the past two decades. The remaining parts would be CIP. Underdrains, moisture proofing, and granular backfills would be used to ensure dry tunnels. The water collected by the underdrains would be discharged into the cooling ponds, which would roughly encircle the

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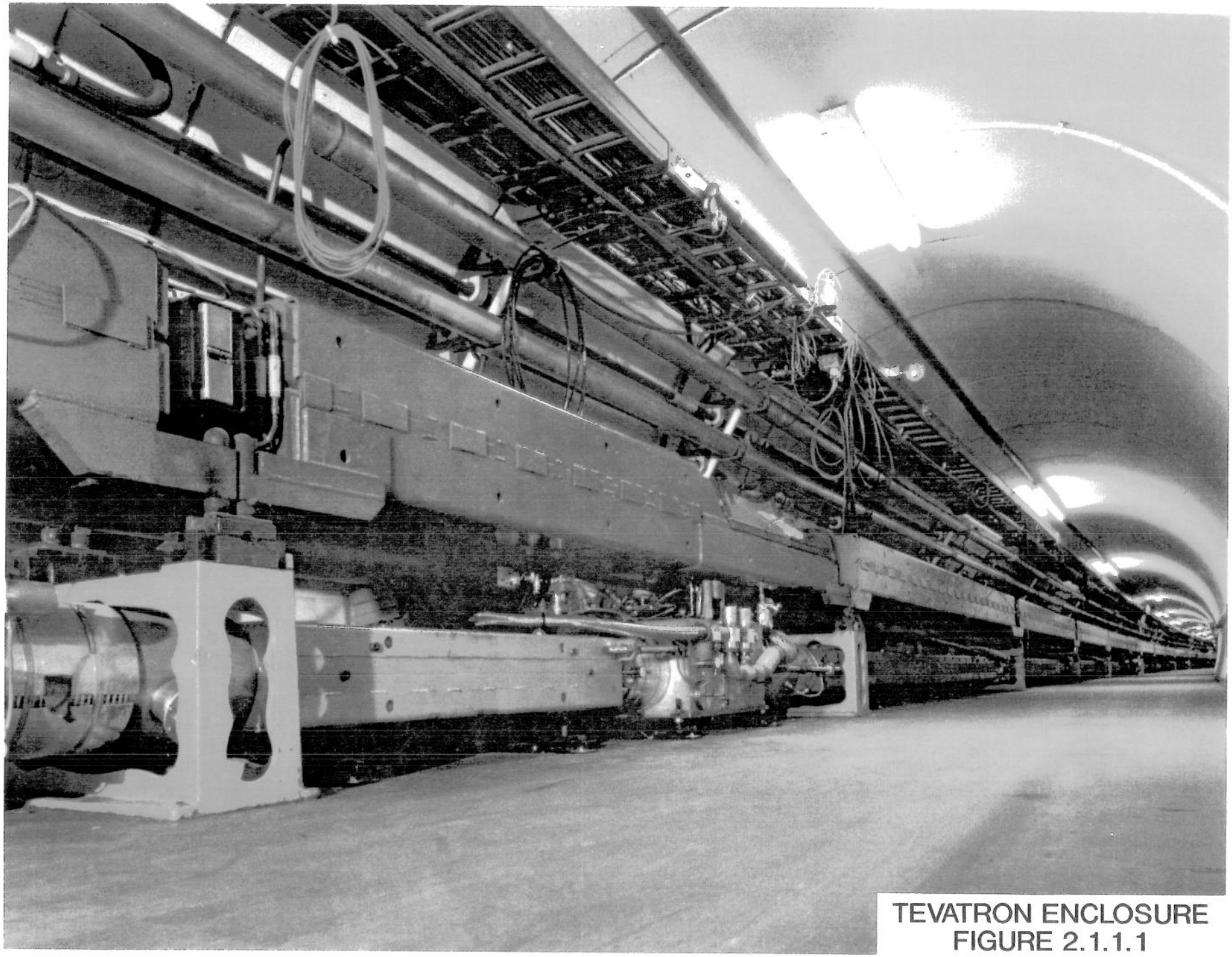
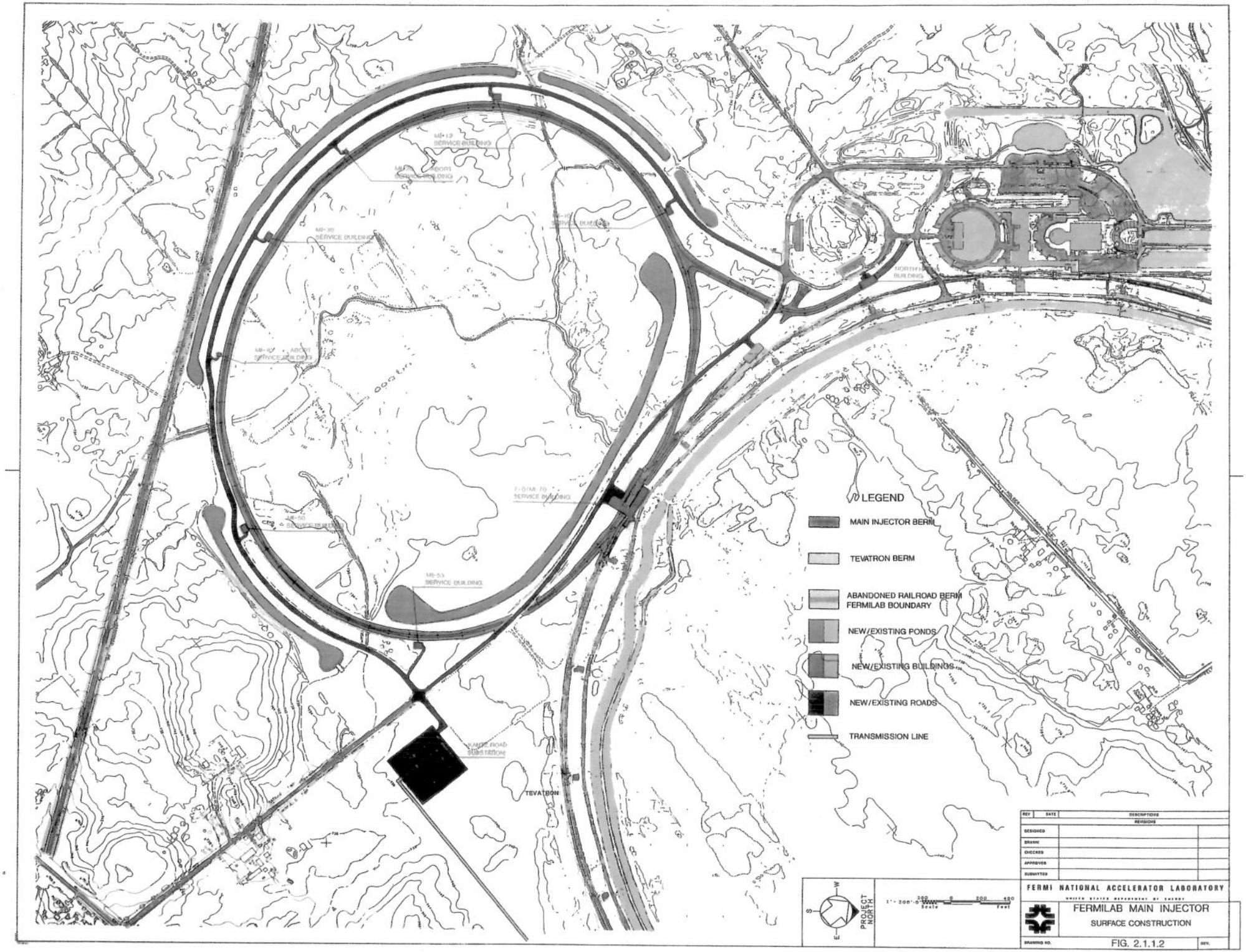
[1]The Main Ring and the Tevatron accelerators are designed with six straight sections, where the beam travels a short distance in a straight line, alternating with six arc sections where it follows the path of a circle with a radius of one kilometer. These 150-meter long straight sections are labeled A0, B0, ... F0, and are spaced equally around the ring (see Figure 1.1.2).



TEVATRON ENCLOSURE
FIGURE 2.1.1.1


LEGEND
MAIN INJECTOR BERM
TEVATRON BERM
ABANDONED RAILROAD BERM
FERMILAB BOUNDARY
NEW/EXISTING PONDS
NEW/EXISTING BUILDINGS
NEW/EXISTING ROADS
TRANSMISSION LINE
TEVATRON
PROJECT NORTH
1" = 200'-0"
Scale
Feet
REV
DATE
DESCRIPTION
REVISIONS
DESIGNED
DRAWN
CHECKED
APPROVED
SUBMITTED
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
FERMILAB MAIN INJECTOR
SURFACE CONSTRUCTION
DRAWING NO.
FIG. 2.1.1.2
REV.

below grade enclosure, as shown in Figure 2.1.1.2. Cutrine, which is used in Fermilab's existing cooling ponds, would also be used as an algicide in the proposed FMI cooling ponds.

The locations of the proposed cooling ponds, which would have a surface area of 16.3 acres, are shown in Figure 4.1.3.1. The average water temperature would be 52.7°F, about 4° higher than the average mean temperature at Fermilab.

Cable trays, power bus, piping, lighting, and other utilities would be ceiling- or wall-mounted. Penetrations would connect to the service buildings from the FMI tunnel's utility alcoves.

Equipment access to the ring tunnel would be provided by an open hatch and semi-circular labyrinth. Personnel access stairs to the FMI would be provided at the 6 Main Service Buildings and at the 2 Abort Service Buildings as shown on Figure 2.1.1.2.

In addition to the FMI ring tunnel, various beam transport tunnels, which convey protons and antiprotons, are proposed to be constructed for the following beam transport lines:

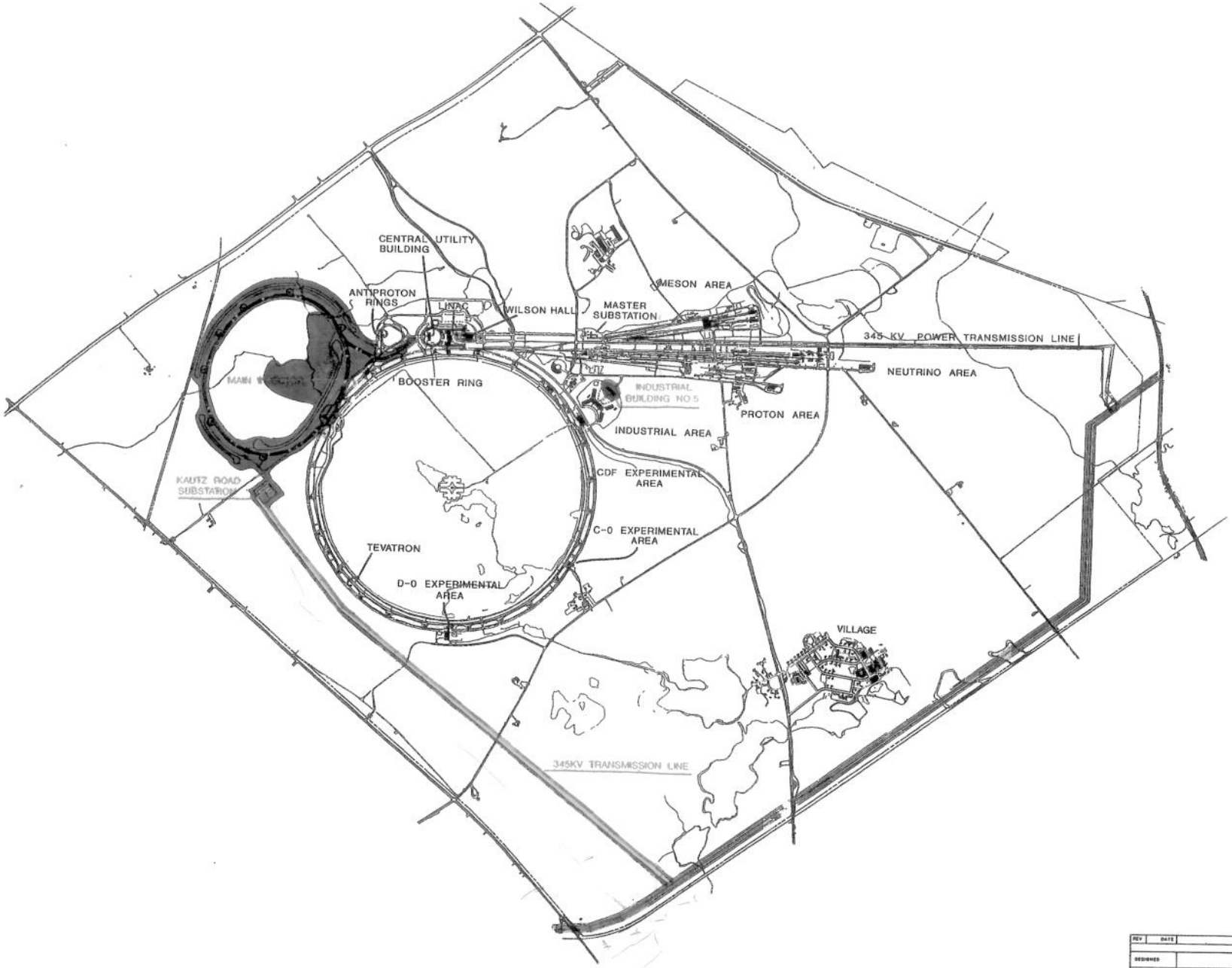
1. 8 GeV protons from the Booster to the FMI.
2. 150 GeV protons from the FMI to the Tevatron.
3. 150 GeV antiprotons from the FMI to the Tevatron.
4. 120 GeV protons from the FMI to the Antiproton Target.
5. 8 GeV antiprotons from the Antiproton Source to the FMI.
6. 120 GeV protons from the FMI directly to the beam extraction lines for the Fixed Target Areas.

The proposed AB-5 would be constructed and used for component fabrication and final assembly for many of the FMI magnets. The addition of this building to Fermilab's existing Industrial Area would allow magnet production to be completed without impacting Fermilab's ongoing magnet programs.

AB-5 would be constructed north of the present Industrial Area rear parking lot in a fallow site immediately across from the present Industrial Building Center Building. (See Figure 2.1.1.3 that shows in brown the proposed construction areas.) Siting the new building at this location in Fermilab's existing Industrial Area would allow use of existing parking areas and provide convenient access to the facilities and personnel in the Industrial Area.

In addition to AB-5, 7 new small service buildings and an addition to an existing service building at F0 are proposed to be constructed. These proposed buildings, which would be located around the perimeter of the FMI, are shown in Figure 2.1.1.2. The project would also require construction of a new building, termed the North Hatch Building, also shown in Figure 2.1.1.2, above the tunnel that would convey protons from the Booster to the FMI.

In order to supply power to the FMI, a new 345 kV overhead transmission line would be installed on the Fermilab site roughly parallel with State Route 56 (see Figure 3.3.2). The proposed line, which is shown in Figure 2.1.1.3, would terminate at the new Kautz Road Master Substation (KMS), also shown in Figure 2.1.1.3.



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UNITED STATES DEPARTMENT OF ENERGY

FERMILAB MAIN INJECTOR

CONSTRUCTION SITES

DRAWING NO. FIG. 2.1.1.3 REV.

The construction techniques and methods that would be used to construct the proposed FMI would be similar to proven construction methods previously used at Fermilab. The architectural style of the proposed buildings would reflect, and would be harmonious with, existing adjacent buildings. Existing topography, watersheds, vegetation, natural habitat and site boundaries have been carefully observed and considered in the layout of the new project.

Provisions to meet radiation safety, fire protection and conventional safety requirements were included in the FMI conceptual design process and would be included in all design, construction, and operation. Energy-efficient construction techniques would be incorporated into all new structures. Quality assurance provisions would be part of all project phases.

2.1.2 Utility Services

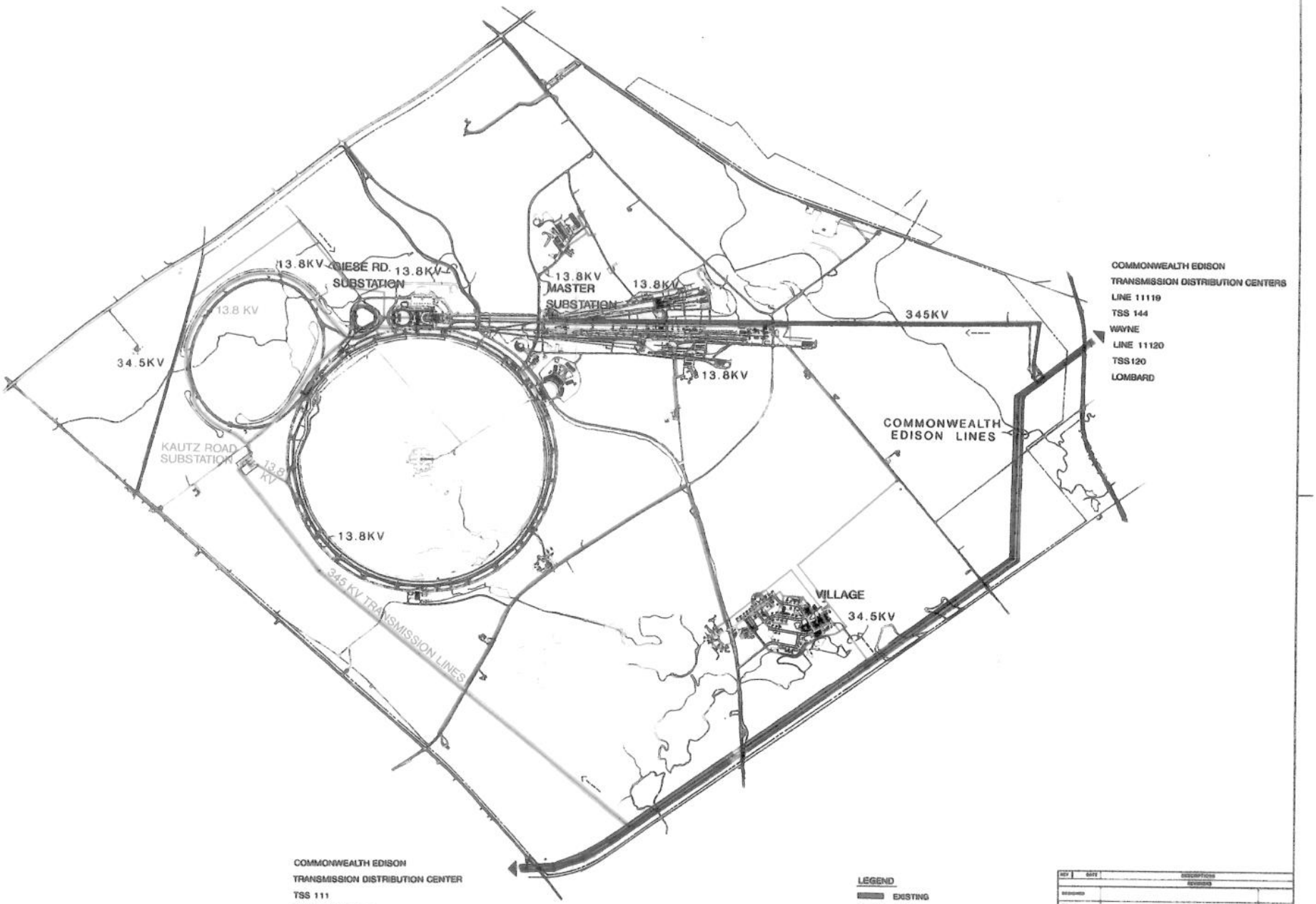
Since the proposed FMI would be constructed on the Fermilab site, utility services for the FMI would be carefully integrated into the existing systems. Primary distribution systems for utilities at Fermilab include domestic water, industrial cold water, sanitary sewer, natural gas, electrical power, and telecommunications. There is only one centralized utility plant, Building 214, on the Fermilab site. It supplies both hot and chilled water to Wilson Hall (identified on Figure 2.1.1.3) and the other adjacent buildings for heating and cooling needs. Most service utilities exist at intercept points near the proposed FMI project. A new transmission line and a new substation would be built as part of the proposed project to service the FMI as well as to augment Fermilab's existing electrical service. Utilities and services are available near the location of the proposed AB-5 and would be extended to the proposed building.

2.1.2.1 Electrical power distribution

2.1.2.1.1 Existing Fermilab systems. Two independent transmission lines from the Commonwealth Edison Company provide power to Fermilab. Line 11120 is the preferred line between the Electric Junction and Lombard Substations; Line 11119 between the Electric Junction and Wayne Substations is the emergency line. At the Master Substation, the 345 kV is transformed through five 40 MVA and one 60 MVA transformers to 13.8 kV for underground distribution through 22 feeder breakers. In addition, 34.5 kV lines from Electric Junction serve the Village 12.4 kV overhead distribution system and provide emergency 13.8 kV from the Giese Road Substation.

Approximately 280 substations are fed from 15 miles of overhead cable and 100 miles of underground cable. (See Figure 2.1.2.1; proposed power distribution lines are shown on a background of yellow.) The federally owned and Fermilab operated system is maintained by Fermilab personnel. All high voltage systems are operated and coordinated in accordance with Fermilab safety procedures.

2.1.2.1.2 Additional requirements for proposed FMI. The additional power requirements directly associated with the proposed FMI would be 13.5 MW, of which 12 MW would be for the FMI ring and 1.5 MW would be for the beamlines. After reviewing various possibilities for providing the 13.5 MW of electrical power, it was decided to propose a new 345 kV switching station along the existing transmission line corridor at the southeast corner of the Fermilab site. (See Figure 2.1.2.1.) A new, approximately 13,000'-long, 345 kV overhead transmission line would be installed on the


13.8KV
CIESE RD.
SUBSTATION
13.8KV
13.8KV
MASTER
SUBSTATION
13.8KV
345KV
13.8 KV
34.5KV
13.8KV
COMMONWEALTH
EDISON LINES
KAUTZ ROAD
SUBSTATION
13.8
KV
13.8KV
345 KV TRANSMISSION LINES
VILLAGE
34.5KV
COMMONWEALTH EDISON
TRANSMISSION DISTRIBUTION CENTERS
LINE 11119
TSS 144
WAYNE
LINE 11120
TSS 120
LOMBARD
COMMONWEALTH EDISON
TRANSMISSION DISTRIBUTION CENTER
TSS 111
ELECTRIC JUNCTION
LEGEND
EXISTING
NEW
PROJECT NORTH
FERMI NATIONAL ACCELERATOR LABORATORY
FERMILAB MAIN INJECTOR
POWER DISTRIBUTION
FIG. 2.1.2.1

Fermilab site roughly parallel with Butterfield Road. The line would terminate at the Kautz Road Master Substation, termed the KMS. Double arm steel poles with an average span of 1,000' would carry a single 345 kV circuit with static shield wires. The new KMS would be built on a 400' x 400' rock base and be enclosed with a security fence with an access gate to Kautz Road. The substation would be built on Fermilab property in a recently cultivated, well-drained area, lying just south of the Tevatron berm. See Figures 2.1.1.2 and 2.1.2.1.

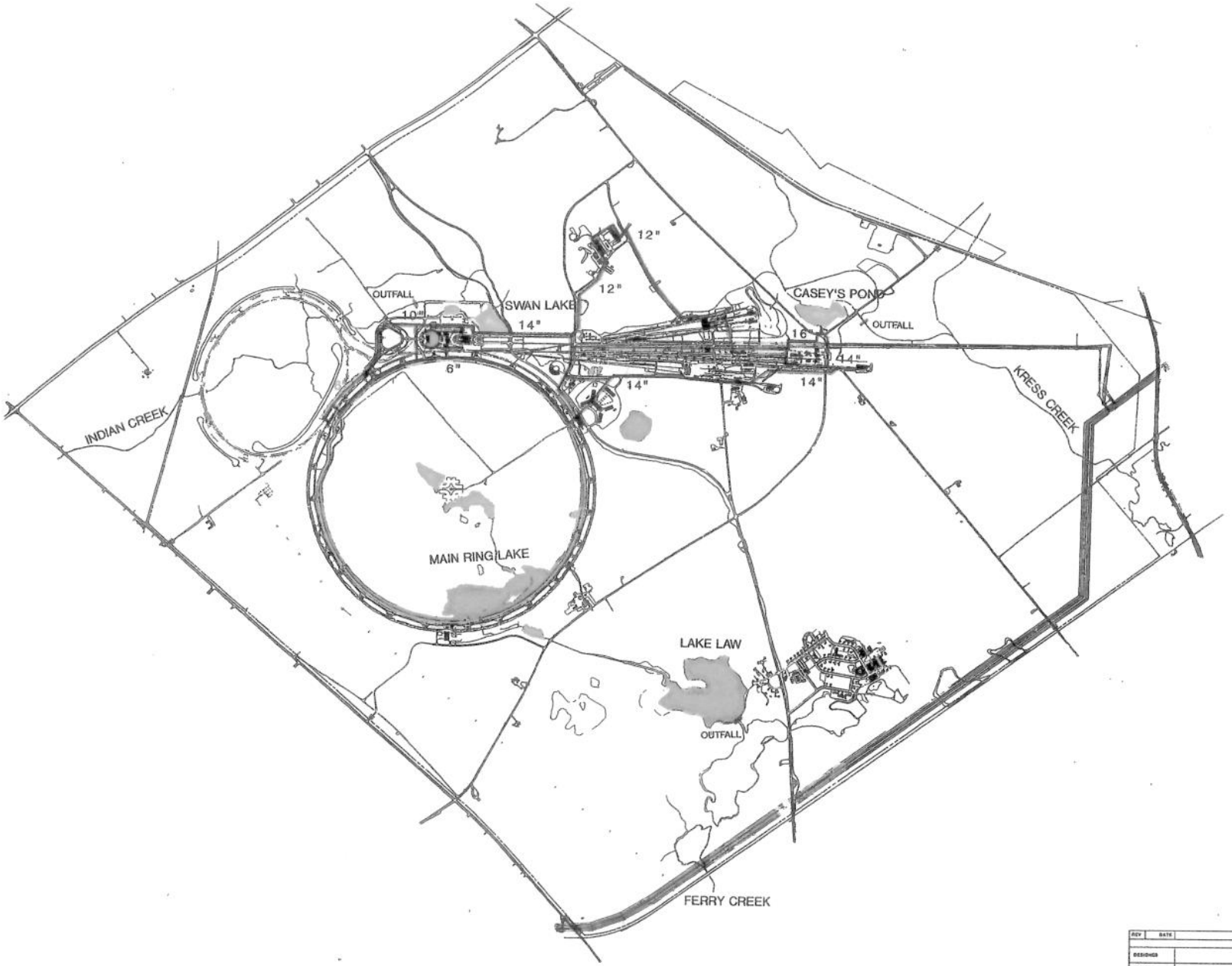
Two new transformers (40 MVA each) and two existing transformers from the existing Master Substation would be installed in the KMS. This would increase the total installed ac power at Fermilab from 260 MVA to 340 MVA, a net increase of 80 MVA. This would accommodate the power demands of the proposed FMI and improve power redundancy of the Fermilab site. Underground concrete-encased ductbanks with precast concrete manholes would route the 13.8 kV feeders from KMS to the various FMI power systems. Other ductbanks would connect back to the Main Ring ductbanks at appropriate points. With these connections and the use of 6 existing Main Ring feeders, approximately 40 MVA of primary power could be back-fed to the Master Substation. This would substantially improve the redundancy of primary power for the Fermilab site.

Three separate power systems would be associated with the FMI: 1) a power system for pulsed power supplies; 2) a power system for beamlines; and 3) a conventional power system. In any electrical equipment that contains oils, PCBs would not be used. Reused transformers would be PCB-free.

For the proposed AB-5, lighting levels for office and technical spaces would be 75 foot candles and 20 foot candles for all other areas. Power outlet distribution would be according to the activities in the various areas. A 1,500 kVA substation would be installed near the west end of the building and would connect to a 2,000 amp switchboard to serve the various power needs within the new building. Primary power for this new substation would be provided by extending 13.8 kV Feeder 47.

2.1.2.2 Primary cooling and distribution systems. Fermilab's existing Industrial Cold Water (ICW) System (see Figure 2.1.2.2) has a dual purpose. First, it is used to supply water to the various fire protection systems. Second, it is utilized in many of the experimental areas for conventional magnet cooling. The cooling of experimental equipment involves the use of ICW and Low Conductivity Water (LCW), which is described below. The ICW is passed through heat exchangers where it receives heat from the LCW. The ICW is then pumped to cooling ponds where most of the heat is dissipated by evaporation. Due to natural surface flows, some cooling pond water currently is released to surface waters, such as Indian Creek.

The distribution system for ICW extends from the main pumping station at Casey's Pond to Wilson Hall and its adjacent buildings, and to most of the experimental areas located on the Fermilab site. The main storage reservoir for the ICW System is Casey's Pond, which is located in the northern portion of the Fermilab site. There are 2 sources that provide water to the reservoir. A site-wide network of lakes and ditches is used to collect surface runoff, as well as heat exchanger and sump discharge water, and transfer it to Casey's Pond. Water is also collected in Main Ring Lake, located within the main accelerator ring, and Lake Law, located in the southeast portion of the site. The water from these lakes can then be transferred to Casey's Pond by means of a pumping station located at the Main Ring Lake. Thus, the entire 6,800-acre Fermilab site provides runoff to this



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FERMILAB MAIN INJECTOR

INDUSTRIAL COLD WATER SYSTEM

DRAWING NO. FIG. 2.1.2.2 REV.

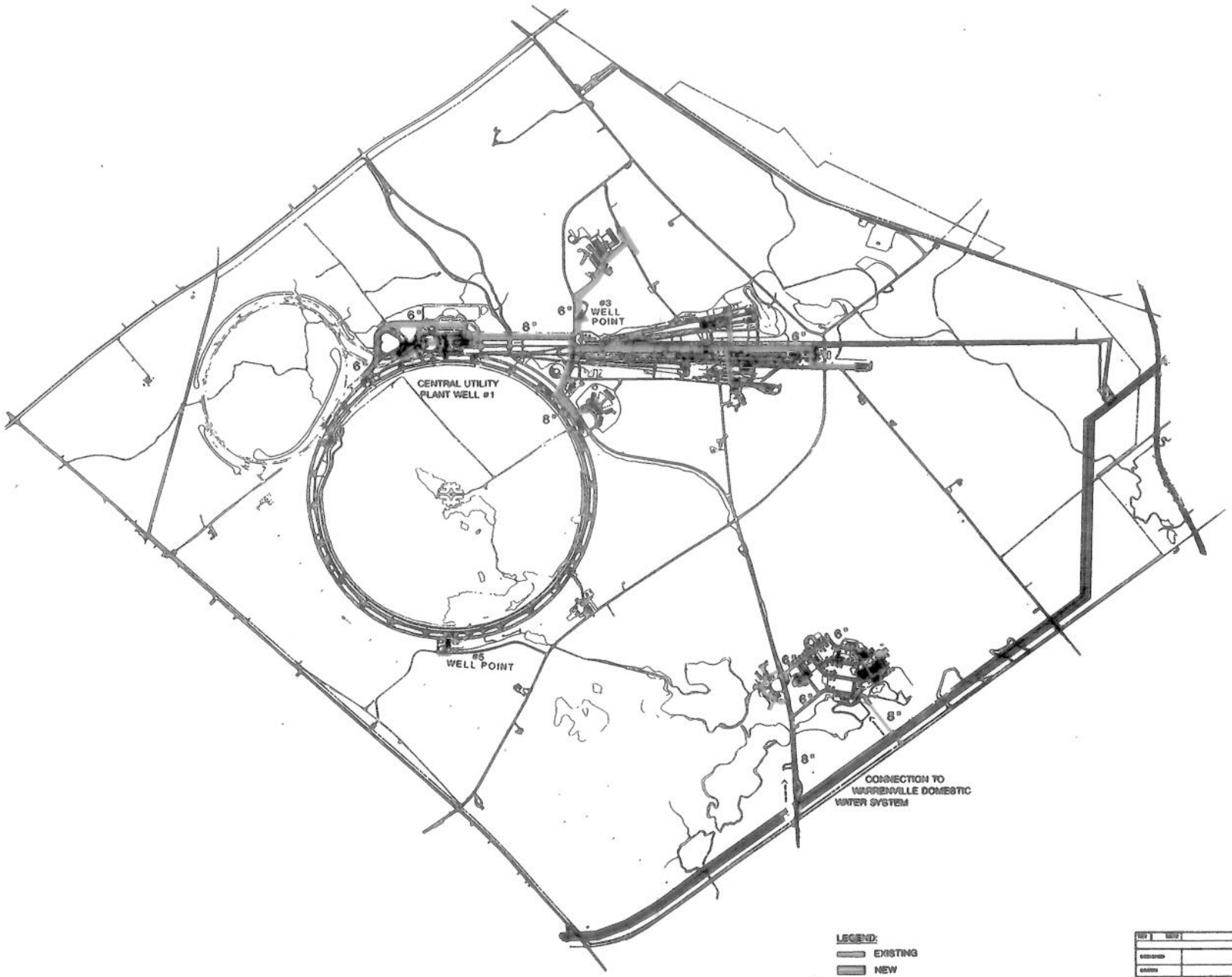
network of ditches and lakes, and even open areas of the site contribute to the experimental effort of the Laboratory. The Fox River is a second source that is used to supply ICW. A permit from the State of Illinois allows Fermilab, when water levels are sufficient, to pump water from the Fox River to Casey's Pond.

The present total volume of the ICW System is 185.7M gallons based on existing lake and ditch sizes and average rainfall. Building 855, the pumping station at Casey's Pond, contains three 5,000 gpm variable speed primary pumps and three 1,500 gpm single-speed secondary pumps that supply water to the site-wide distribution system. The average pumping output of the Casey's Pond pumping station is primarily dependent on the water temperature of the reservoir. This temperature varies with the time of year and the amount of experimental equipment that requires cooling. In the winter months, with minimum cooling demand from equipment, the output may be as low as 4,000 gpm. In the summer months, with a maximum cooling demand, the output could exceed 11,000 gpm, a level which approaches the upper limit of the overall system's cooling capacity (i.e., 13,000 gpm). However, the existing system can accommodate the relatively insignificant 200 gpm increase associated with the proposed FMI.

The ICW requirements of the FMI project would be incorporated into the site-wide system. However, the usage of the ICW, except for the external beamlines associated with the fixed target program, would be limited to cooling pond make-up. A new cooling pond system, which is described below, would be constructed for primary heat rejection of the 13.5 MW generated by the FMI in order to meet the FMI's cooling demand. The 200 gpm average cooling pond make-up water needed for the FMI is based on the cooling requirements of the magnets and power supplies. At the same time, the make-up water for the Main Ring cooling ponds would be reduced by a similar amount. Although construction of the FMI would result in reduced usage of the cooling ponds that surround the Main Ring, these cooling ponds would continue to be used to cool compressors associated with the Tevatron.

The proposed interconnected cooling pond system would roughly encircle the new Main Injector Road and provide 16.3 acres of cooling surface. The five new ponds would total about 11,000' in length, average 60' in width and would have an average depth of 4'6" and a maximum depth of 7'. The cooling ponds would also have extra capacity to handle storm water retention demands to meet all state and federal regulations. Because the cooling/retention ponds would be relatively close to the site boundary, they would have relatively gentle slopes to reflect safety considerations. Transverse concrete dams near each new service building would provide intake and discharge piping separation and elevation control. No cooling towers would be used.

The water required to fill the cooling ponds and the make-up during FMI operation would be obtained from the existing ICW System. No chemical treatment of the water would be required beyond normal algacides to control algae and aquatic weeds. The treatment of Fermilab's existing cooling ponds is described in Fermilab's annual "Site Environmental Report." (Cutrine, which is currently used as an algicide in Fermilab's existing cooling ponds, would be used in the FMI's cooling ponds.) ICW piping would extend along Kautz Road to serve the new F-0/MI-70 Service Building and would connect to the existing ICW line on the inside of the Tevatron berm. ICW would also extend from the existing service at the Southeast Booster Lab to the new North Hatch Building. An existing ICW main near the proposed AB-5 would be extended to that new building. A new fire hydrant would be installed in the vicinity.


6"
8"
6"
#3
WELL
POINT
6"
6"
CENTRAL UTILITY
PLANT WELL #1
8"
#5
WELL POINT
6"
6"
6"
8"
8"
CONNECTION TO
WARRENVILLE DOMESTIC
WATER SYSTEM
LEGEND:
EXISTING
NEW
DOMESTIC WATER WELL
PROJECT NORTH
FERMI NATIONAL ACCELERATOR LABORATORY
FERMILAB MAIN INJECTOR
DOMESTIC WATER SYSTEM
FID 2.1.0.0

2.1.2.4 Sanitary sewer system. There are two underground sewage collection systems at Fermilab (see Figure 2.1.2.4). One serves the main site, the other serves the Village. The main site collection system has 6 lift stations; the Village system has 1. No sewage, except for several small septic systems, is treated on site. The City of Batavia treats sewage from the main site on a fee basis. The City of Warrenville handles sewage from the Village under a similar arrangement.

The collection system that serves the main site facilities is in good working condition. A new sanitary sewer line would be installed at proposed AB-5 to connect an existing sanitary line south of the industrial complex. No other connections to the main site sanitary sewer system are planned for the proposed FMI.

Existing septic systems at the Antiproton Target Hall and RF Service Building would be retained. Any portions of the fields disturbed during construction would be replaced.

2.1.2.5 Telecommunication systems. Voice and dial-up data transmission systems are provided by a Remote Module of the Geneva #5 Electronic Switching System (ESS) provided by Illinois Bell Telephone Centrex service. Approximately 2,950 circuits are in use on this system. Primary commercial network access is provided by 137 9-level two-way trunks; 8 foreign exchange (FX) circuits are utilized for access to Chicago and 24 Sprint circuits carry domestic long distance traffic. Various 406 and 879 circuits are provided as stand-alone circuits for individual area access in the event of system malfunction. Six trunks are used for on-site paging. FTS access is provided via 5 two-way trunks. All of these circuits are carried to the Central Office over a DS-3 Link, via a D-4 channel bank, using a fiber optic transmission carrier.

Pay phones and IBT alarms are provided on a hard-wire basis, while access to the nearby Argonne National Laboratory is carried over a digital microwave which is co-owned by Fermilab and Argonne.

Primary data communications capability is provided by the Mycom port selector system operated by the Data Communications Group in the Computing Division. Supplemental data communications is provided on a dial-up basis via the on-site telecommunications system.

Radio communications is provided to Fermilab via a variety of antennas and frequencies. At present, Fermilab has approximately 874 pagers, 152 emergency pagers, 129 mobile radios, and 195 personal two–way units assigned to personnel on site.

A new communication loop encircling the FMI would be installed along the outside toe of the berm. It would extend through the North Hatch Building, enroute to the Booster and connect back to the cross-gallery through a combination of new routing and existing ducts. Connections for telephone service in the tunnels and service buildings would be provided. A communications connection would be made from existing manhole C-25 to serve AB-5.

2.1.3 Operating Conditions, Releases and Wastes

2.1.3.1 Inspections, maintenance and repairs. Operation of the proposed FMI would enable simultaneous operation of the collider and fixed target experimental programs. The normal operation envelope of the Tevatron would still show 1 to 2 months of shutdown per

year in order to incorporate changes and provide for a necessary routine inspection and repair and maintenance period. During accelerator operations, approximately 10% of the time is devoted to accelerator studies in order to make measurements that are needed to maintain efficient operations and to make improvements. Necessary repair periods would occur when component failure requires interruptions of operations in order to replace a critical component. For example, when a Main Ring or Tevatron magnet fails, approximately 1 day is required for Main Ring magnet replacement and 1 week for Tevatron magnet replacement. The longer time required for Tevatron magnet replacement is because of the need to warm-up to room temperature and, subsequently, to cool-down to liquid helium temperature, the superconducting Tevatron magnets. Due to the incorporation of newly designed dipole magnets in the proposed FMI, magnet failure in the proposed FMI would not be expected to be more frequent than once per year.

2.1.3.2 Releases and wastes. The operation of the FMI would generate some releases and wastes, such as small amounts of air emissions from vehicles traveling to and from service buildings and small amounts of radioactive air emissions and releases to soils. Small amounts of low level radioactive wastes and regulated chemical wastes would also be produced. The cooling ponds that would encircle most of the FMI would generally not discharge water to Indian Creek, except during certain flood conditions.

For proposed FMI operations, radiation doses have been calculated for beam losses which are expected to occur during normal operations of the proposed FMI accelerator using the anticipated maximum accelerated beam intensity, number of hours of operation per year, and beam loss rates for conditions covering the full range of the experimental program. Calculations of radiation dose rates have been made also for accident conditions in which the entire beam is lost unexpectedly at any given location in the FMI ring. The shielding calculations which have been done take into account the use of the beam abort dump. All of these conditions comprise the operational envelope of the accelerator. The results of these calculations are summarized in more detail in the remainder of this section.

Radionuclide emissions to the atmosphere due to operation of the Tevatron with the proposed FMI have been estimated to be no more than 1,100 Curies per year. These emissions have been estimated based upon experience gained during present Fermilab operations using the Tevatron with the Main Ring as its injector. These emissions consist of short-lived gaseous emissions produced as an unavoidable result of proton interactions with targets. The principal radionuclides measured to be present include ^{11}C, ^{13}N, ^{41}Ar with ^{11}C and ^{41}Ar each contributing about 40% of the total release and ^{13}N contributing the remainder.

Operating with the present Main Ring as the injector to the Tevatron results in typical annual releases of 80 to 100 Curies. Ventilation controls are used, where feasible, to delay the releases to allow for decay of the radionuclides.

Fermilab's current operations are covered by an air permit from the Illinois Environmental Protection Agency (IEPA) which expires in August 1994. The proposed FMI will represent no essential change in the generation of airborne radionuclide emissions except for the increased beam intensity. It has been found that the airborne release of these radionuclides is proportional to the product of the number of protons targeted and their energy. Emissions with the proposed FMI can thus be reliably estimated by scaling from the present operating conditions. Doing this yields an estimated total release of 1,100 Curies due to proposed FMI operations. Under the National Emission Standards for

connecting beamline tunnels and FMI service and support buildings; 4) construction and installation of FMI magnets, equipment and electronics; and 5) completion of the project, i.e., fine grading and landscaping.

The proposed 135-acre construction site for the proposed FMI contains forest and open fields, some of which are wetlands, and is in the southwest portion of the Fermilab site (see Figure 2.1.1.3). The construction schedule that was developed in the Conceptual Design Report is being updated based on the FY93 budget data sheets. The new schedule will include the 6-year funding profile contained in FY93 budget. DOE presently assumes that construction would start in June 1992 and be completed in 1997. The proposed FMI construction would also involve about 130 workers. The FMI would be constructed in phases with the work broken down as follows:

Phase 1: Site Preparations and AB-5 Construction: FMI site development includes subcontractor mobilization, site protection including erosion and sediment control, survey control, temporary utility installation, 5,500' of rough road construction (15,000 cubic yards (c.y.) of granular fill), 5,600' of the cooling pond construction which would also serve as storm water retention ponds (115,000 c.y. excavation), completion of the wetland mitigation area adjacent to Indian Creek (see Figure 4.1.3.1) (8.6 acres), wetland area fill (5.7 acres), general site drainage and drainage controls, and the completion of AB-5. AB-5 would be constructed during Phase 1 so that magnet assembly can commence.

Phase 2: Construction During Accelerator Operations: Completion of the remaining rough road construction, excavation and construction of 10,000' of the FMI accelerator enclosure (490,000 c.y. excavation; 500,000 c.y. backfill for berm), excavation and construction of 3,000' of the beamline enclosures that are shielded from radiation (90,000 c.y. excavation; 105,000 c.y. backfill), construction of all of the service buildings, the KMS, the 345 kV transmission line, the remaining 5,600' of cooling pond construction (115,000 c.y. excavation; 30,000 c.y. back fill), the final drainage controls and the installation of various utilities and services.

Phase 3: Construction During Accelerator Off Period: Excavation for and construction of the F-0/MI-70 Service Building, which would complete the FMI tunnel (30,000 c.y. excavation; 20,000 c.y. backfill), the remaining 1,000' of beamline tunnels (30,000 c.y. excavation; 35,000 c.y. backfill), and all modifications at existing tunnels.

Phase 4: Site Completion: Site cleanup, final road grading and paving and all landscaping work. All landscaping would be consistent with Fermilab's "Site Development Plan."

The excavated material would be handled so that as much of the material as possible would be reused immediately as fill elsewhere on the construction site. The initial excavated earth would be put in a temporary storage area on an open, previously farmed area near the proposedFMI tunnel. Any excess earth remaining after the completion of the project would be stockpiled for future use in an existing storage area on another part of the Fermilab site.

DOE will ensure compliance with the conditions of the COE permit, issued pursuant to Section 404 of the Clean Water Act, and the IEPA's certification, issued pursuant to Section 401 of the Clean Water Act, that relate to the control of soil erosion from construction areas. Pursuant to Special Condition Number 9 of the COE permit, soil

erosion control measures will be properly installed and functioning prior to the commencement of construction. Qualified persons will periodically inspect the construction site at no less than a monthly basis to ensure proper operation of soil control measures in accordance with Special Condition Number 10 of the COE permit. Reports detailing the results of the inspection, including representative photographs, will also be submitted to COE pursuant to Special Condition Number 10.

DOE will also ensure compliance with the paragraphs of the IEPA certification concerning soil erosion controls. DOE will provide planning and supervision to ensure adequate soil erosion control measures during FMI construction. Paragraph 3 of the certification requires the deposition into a self-contained area of all material that is excavated, dredged or otherwise produced. All areas affected by construction will be mulched and seeded as soon as possible pursuant to Paragraph 4 of the certification. Pursuant to this paragraph, interim measures will be used to prevent soil erosion during construction, such as straw bales, sedimentation basins, and temporary mulching. All construction within Indian Creek will be conducted during zero or low flow conditions. The channel relocation will be stabilized to prevent erosion prior to the diversion of flow.

Pursuant to paragraph 5 of the IEPA certification, DOE will implement erosion control measures consistent with the "Standards and Specifications for Soil Erosion and Sediment Control." (IEPA/WPC/87-012). These standards and specifications are employed in the design, review, approval, installation and maintenance of erosion and sediment control practices on land undergoing clearing, grading and development. This information allows those responsible for erosion and sediment control plant design, review and approval to evaluate site specific conditions such as soils, drainage, proposed clearing and grading, etc., so that the most effective erosion and sediment controls can be implemented at the lowest cost.

The standards and specifications are also intended to be a reference guide for construction personnel who will implement and maintain the controls. A section on the basic principles of erosion and sediment control is included to give these individuals a better understanding of the function of the sediment controls being installed.

The control practices have been organized into four functional categories: (1) temporary structural practices; (2) permanent structural practices; (3) vegetative practices (temporary and permanent); and (4) special practices.

Temporary structural practices are those used for relatively short periods of time, (e.g., straw bale dikes, which are effective for 3 months). Such measures will be implemented to ensure erosion or sediment control during certain phases of construction.

Permanent structural practices are designed to remain in place and functioning following completion of construction. Such controls include diversions and grassed waterways.

Structural practices are constructed to control the flow of water and possible resultant erosion, or to trap sediment so that off-site sedimentation does not occur. Vegetation practices are concerned with stabilizing the soil surface to prevent erosion. The retention of natural buffer areas along the periphery of the site will assist in ensuring that grading and construction activities will not adversely affect adjacent properties or water resources.

The first phase of the proposed FMI construction would be the creation of the wetland mitigation area. Based on the current construction schedule, all excavation associated with this activity would be complete before October 1, 1992. Accordingly, under the current construction schedule, this activity would not be subject to the stormwater permit requirement. If construction of the wetland mitigation area is underway on October 1, 1992 and will continue after that date, a stormwater permit application will be filed with IEPA.

DOE would submit to IEPA a stormwater permit application prior to the construction of the proposed FMI cooling ponds since this activity would disturb more than 5 acres and would occur after October 1, 1992.

DOE would control stormwater runoff from construction areas pursuant to the stormwater-discharge permit that will be issued by the IEPA. Planned control measures include limiting exposed areas, surface water diversion, velocity control, slope stabilization, collection of runoff, water/solids separation, and post-construction restoration. After construction, unused disturbed areas would be revegetated or restored as soon as practicable to minimize the volume and turbidity of surface runoff.

Because beam alignment is a basic concern for the proposed FMI, it would be essential that its concrete foundation slab be constructed with only minimal settlement. The main enclosure would have a level floor at elevation of 713'6" and at a depth from 18' to 33' below existing grade. Any existing unstable areas under the tunnels would be excavated and backfilled with engineered structural fill to prevent settlement.

FMI construction would proceed using two groups of construction workers. Two scrapers, one backhoe, three dump trucks and two bulldozers would be used in each group. Miscellaneous autos and light duty trucks would also be used. About 100 autos would arrive and leave daily with workers during the peak construction period via the Kautz Road entrance. The estimated maximum noise level at the site boundary (>200' from the construction area) would be about 65 dB. The noise restrictions on construction near the heron rookery, that were recommended by the ornithologist will be respected (see Section 4.1.7.1). Construction of the FMI would proceed in a routine fashion, following well established practices, and in coordination with the permitting agencies.

In accordance with 10 CFR Section 1022.14, this EA incorporates a Floodplain/Wetlands Assessment. On June 11, 1991, DOE published a Notice of Floodplain and Wetland Involvement for the proposed FMI in the Federal Register. No comments were received by DOE.

As discussed in Chapter 4, the flow at Indian Creek and its tributaries would be diverted temporarily as required to keep immediate construction areas dry. The normal water courses would be restored as construction work in the creek area is completed. Following construction, although Indian Creek will be permanently diverted through a system of culverts and ditches, the normal flows through the center of the FMI would be unimpeded in order to maintain a satisfactory environment for the resident wildlife.

2.1.5 Work Force

In 1988 the State of Illinois and the DOE published assessments of socioeconomic and infrastructure consequences of siting of the SSC in Illinois. By appropriate scaling, these results can be applied to the FMI project and show that approximately 130

construction workers would be required to construct the proposed FMI. DOE anticipates that operation of the proposed FMI would require no increase in Fermilab's work force. This is because the proposed FMI replaces the Main Ring, and therefore the present operations and maintenance staff for the Main Ring would take over the operations and maintenance of the FMI. It is anticipated that since the FMI would be new and incorporate state-of-the-art components, the FMI would require less maintenance man-hours than the Main Ring.

The growth of the Fermilab staff is shown in Figure 2.1.5.1. The distribution of the Fermilab work force is shown in Figure 3.3.1, with 80% of these people living in Kane and DuPage Counties. Considering that a number of FMI workers would transfer from existing Fermilab activities to the FMI during its operation, the actual number of staff added to the current Fermilab work force of 2,335 persons by the FMI would be zero. It is assumed that the additional construction work force would have the same general residence pattern as existing employees.

2.1.6 Decommissioning of the Main Ring. The procedures outlined below in Sections 2.1.7.1 (shutdown) and 2.1.7.2 (survey of residual activities) would be applied to the Main Ring decommissioning. Components which are to be reused in the FMI such as the quadrupole magnets would be disconnected and removed from the Tevatron tunnel. Since most components are bolted or sealed by flanges, no radioactive waste generally would be generated during the disconnecting and removal process. In some cases metal filings which are likely to be radioactive will result from cutting free the beam pipe where no bolted flange exists. Under these circumstances the filings will be caught and collected and packaged according to DOT specification, then shipped to a DOE operated radioactive waste disposal site. The reuseable components divide into two categories.

1. Contamination-free components would be removed to a temporary storage area where they would await deployment to the FMI.

2. Reusable items, such as the quadrupole magnets, with some residual radioactivity would be removed under health physics supervision and stored in a separate radiologically controlled location on-site for future use at the FMI. Experience indicates that components containing some residual radioactivity from decommissioned accelerators constitute a major resource which saves the public a great deal of money when recycled in this manner. In all cases, radioactive and nonradioactive components would be kept segregated.

Another category of items associated with the decommissioning would be items which are taken out of the Main Ring but are not to be reused in the FMI. An example is the beam extraction magnets currently located at the E0 straight section. These magnets would be stored in a portion of the Tevatron tunnel system that will not be used when the FMI is brought into operation, such as the 8 GeV (Booster to Main Ring).

Most of the Main Ring dipole magnets would be left in place. They would be available for future use as the need developed.

There would be no decommissioning of conventional facilities associated with the Main Ring since these would remain in use by the Tevatron. There would be no hardware and equipment installed outside the accelerator enclosure which would need to be excessed.

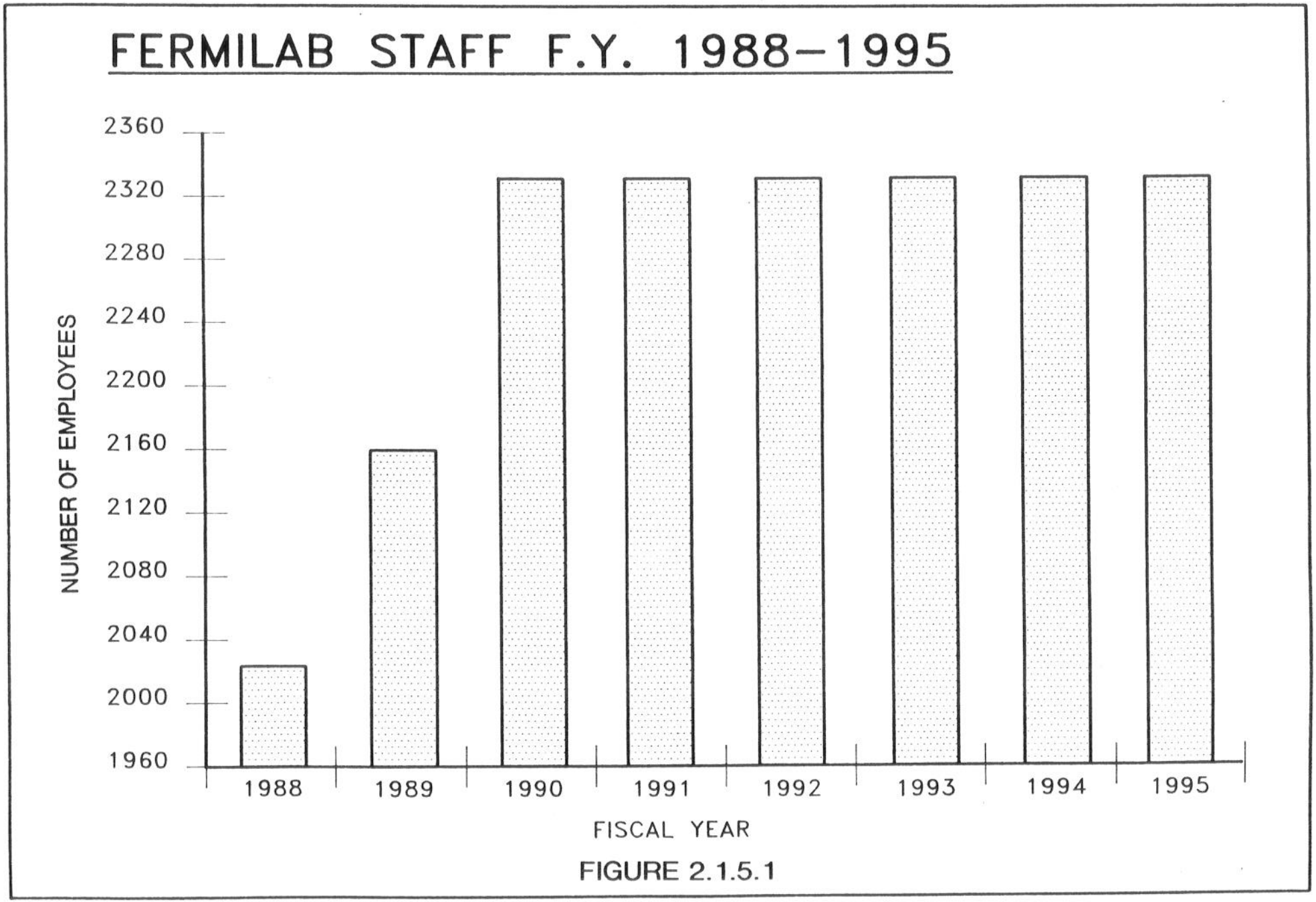

FERMILAB STAFF F.Y. 1988–1995
NUMBER OF EMPLOYEES
2360
2320
2280
2240
2200
2160
2120
2080
2040
2000
1960
1988
1989
1990
1991
1992
1993
1994
1995
FISCAL YEAR

FIGURE 2.1.5.1

2.1.7 Decommissioning of Proposed FMI

It is difficult to estimate the useful lifetime of the FMI accelerator. It is presently anticipated that the FMI would be in service well into the 21st Century.

Nevertheless, it is prudent to consider decommissioning procedures that might be involved some 20 to 30 years after initial operation, in particular, if such considerations lead to design variants that might not otherwise be incorporated. Decommissioning experience at Brookhaven National Laboratory's (BNL) Cosmotron, the Pennsylvania/Princeton Accelerator (PPA) rapid cycling proton synchrotron, and the Argonne National Laboratory's (ANL) 12.5 GeV proton synchrotron provide a relevant experience base in developing decommissioning plans for the FMI.

DOE believes that sufficient information is already available from the similar accelerators mentioned above that it can be reasonably forecast that the FMI decommissioning would present no unique problems. It is also judged that currently available technology is adequate. From a radiological perspective, accelerators are appropriately classified as very low-level facilities and therefore do not require unusual or particularly complicated decontamination procedures. Equipment and facilities installed outside of the accelerator shielding enclosures and the earth surrounding the tunnel would receive some activation.

DOE anticipates that decommissioning of the accelerator and storage ring facilities would proceed in three phases:

2.1.7.1 Shutdown. After orderly shutdown and disconnection of operating systems, electrical power, and cooling water systems to the accelerator facilities, physical and administrative controls for limiting access to the facilities would be maintained.

2.1.7.2 Survey of residual activities. Every component in the accelerator tunnels would be surveyed by health physics personnel to identify and tag any radioactive components. Based on the documented radiation survey, an inventory of all activated materials and equipment would be made and kept under continued surveillance and maintenance. It is anticipated that all components, except for the extraction equipment and shielding in the vicinity of the extraction areas, would be essentially radioactivity free. The level of activity in extraction equipment and shielding would depend upon the length of operation, but dose rates are not expected to exceed a few tens of millirems per hour at an 8-cm (3-in) distance. As a result of this phase, all excess accelerator equipment would be categorized by type and radioactivity level and would be prepared for removal.

2.1.7.3 Removal of components and dismantling. It is anticipated that the inventory would include three general categories of components:

1. Contamination-free components would be removed to a temporary storage area. Experience at decommissioning of other accelerator facilities indicates that magnets, power supplies, and vacuum pumps belong to this category and are frequently reusable at another accelerator facility.

2. Reusable items with some residual radioactivity would be removed under health physics supervision and stored in a separate radiologically controlled location for future shipment. Packaging and shipment of these items would follow U.S. Department of Transportation (DOT) specifications. For example, the

decommissioned electron linac from the Harvard/MIT 6-GeV synchrotron was relocated and is currently used as the injector for the National Synchrotron Light Source at BNL. Past experience indicates that components containing some residual radioactivity from decommissioned accelerators constitute a resource which saves the public a great deal of money when recycled in this manner.

3. Nonreusable items with some residual radioactivity would be packaged according to DOT specifications and shipped to a DOE-operated radioactive waste disposal site. This might involve the cutting of large pieces, under health physics supervision, into sizes suitable for shipment. In all cases, radioactive and nonradioactive components would be kept segregated.

Decommissioning of conventional facilities would follow after all activated components are identified and removed. No parts of the building structures or equipment are expected to be activated; therefore, they would be available for reuse. Hardware and equipment installed outside the accelerator enclosure would be excessed using standard Fermilab procedures for disposition of government properties.

2.2 ALTERNATIVES

2.2.1 No Action Alternative

The need for the project is discussed in Section 1.2. Also discussed in that section was the HEPAP Subpanel's April 1990 report, which recommended immediate commencement and prompt completion of FMI construction. In addition the reaffirming of the April 1990 Report's recommendation concerning the FMI which occurred as a result of the October 28 and 29, 1991 meeting of HEPAP is mentioned. To take no action would fail to accomplish the objectives which led HEPAP to make its recommendation.

Without the FMI, Fermilab would continue to conduct a research program, but, as said in 1.2, with considerably reduced capability. However, no further improvement in luminosity at Fermilab would be possible beyond 1993. Limitations associated with the Main Ring prevent Fermilab from creating the concentrations of protons and antiprotons necessary to produce an adequate number of collisions for an improved research program. The discovery of the top quark would be postponed until the SSC became operational in the year 2000 or beyond. The no action alternative would also decrease the capability to effectively use the SSC when it becomes operational. This is due to the following:

- The scientists who will plan and perform the first experiments at the SSC have to have experience operating large colliding detectors such as those that would be used with the proposed FMI. There is no substitute for this hands-on experience..

  The Fermilab colliding detector experience is most applicable to the design of the SSC detectors since the event rates, backgrounds, and geometries are similar to those at the Tevatron when it has been upgraded with the proposed FMI. This is not true for any other DOE facility.

- High energy collisions at the SSC will have so many particles generated in each collision that it requires fine segmentation of the detector in order to classify events. In addition, elaborate calibration of various detector systems is required.

Optimizing the parameters of the SSC detectors will require data generated with the proposed FMI.

The FMI would improve the efficiency of data collected during the collision of protons and antiprotons in the Tevatron. Data are collected by two detectors CDF and Dzero. Information gathered by these detectors is the heart of Fermilab's collider research. Currently, however, the detectors identify superfluous background noise caused by the Main Ring since it and the Tevatron are located in the same tunnel. By replacing the Main Ring with the FMI, the background noise would be eliminated, allowing a much clearer picture of the collision and of the matter created in the experiments. Without the FMI the experiments would limp along with this handicap.

Thus, the no action alternative would hamper Fermilab from continuing a state-of-the-art research program and impede the design and operation of the SSC.

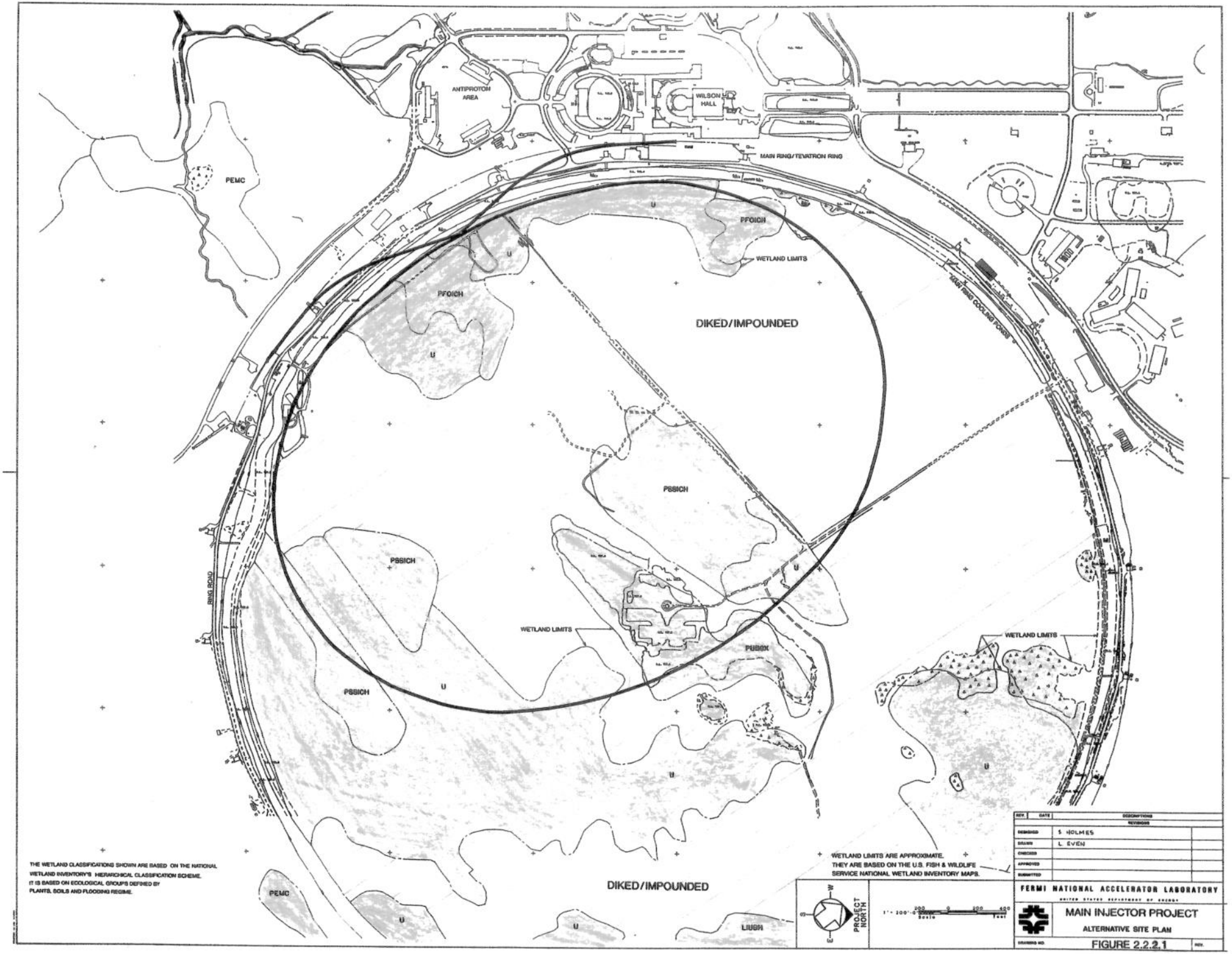
2.2.2 Construction at Another Site

2.2.2.1 Construction at alternative sites immediately adjacent to the Tevatron. Only 2 technically feasible alternative project locations immediately adjacent to the Tevatron exist: (1) the proposed site and (2) the alternate site inside the Main Ring at straight section F0. (See Figure 2.2.2.1.) It is not technically feasible to design beamlines that meet all the criteria needed to transport high intensity beams with the required properties if the proposed FMI is constructed at other locations.

Once the FMI is operational, the protons and antiprotons must travel from the Booster and Antiproton Source, respectively, to the FMI and then into the Tevatron. (See Figure 1.1.2.) Consequently, beamlines must connect the Booster and Antiproton Source with the FMI and the FMI with the Tevatron. Additionally, beamlines must connect the Tevatron with the facilities in which fixed target experiments are conducted.

Connections from the FMI to the Tevatron must to be located at one of the 6 Tevatron utility straight sections (labeled A0...F0). (See Figure 1.1.2.) This is due to the geometry of the Main Ring accelerator and the fact that the Tevatron's geometry had to conform to the Main Ring's. The configuration of the 6 long straight sections that was incorporated into the Main Ring accelerator in 1970 was judged the most appropriate to meet the needs of the Laboratory. The B0 and Dzero straight sections are occupied by colliding detector apparatus while A0 houses the Booster injection and external beam extraction magnet systems, effectively ruling these areas out. This leaves C0, E0, and F0 (inside the Main Ring) as alternative candidates for siting of the FMI. The FMI needs to be tangent to the Tevatron at one of these locations and, in principle, could be either to the inside or to the outside of the Tevatron enclosure. Technical requirements for beamline design such as matching position, angle and other beam properties lead to the rejection of C0 and E0. Therefore, the only potentially viable alternative site to that proposed is concentric to the inside of the Tevatron enclosure at F0. (See Figure 2.2.2.1.)

This alternative site would lie concentric with the Main Ring tunnel between F0 and A0, displaced approximately 100 meters to the inside. The 100 meter separation is required to avoid constructing the FMI within the existing Main Ring/Tevatron utility corridor underneath the existing cooling ponds. The FMI must lie along this segment of the circumference of the Main Ring tunnel due to the need to connect to the existing 8 GeV Booster and the Antiproton Source, as well as to the Tevatron through available straight sections.


ANTIPROTON AREA
WILSON HALL
MAIN RING/TEVATRON RING
PEMC
PFOICH
WETLAND LIMITS
PFOICH
DIKED/IMPOUNDED
TEVATRON COOLING POND
PSSICH
PSSICH
RING ROAD
WETLAND LIMITS
PUBDX
WETLAND LIMITS
PSSICH
U
DIKED/IMPOUNDED
PEMC
LIUSN
THE WETLAND CLASSIFICATIONS SHOWN ARE BASED ON THE NATIONAL WETLAND INVENTORY'S HIERARCHICAL CLASSIFICATION SCHEME. IT IS BASED ON ECOLOGICAL GROUPS DEFINED BY PLANTS, SOILS AND FLOODING REGIME.
WETLAND LIMITS ARE APPROXIMATE. THEY ARE BASED ON THE U.S. FISH & WILDLIFE SERVICE NATIONAL WETLAND INVENTORY MAPS.
PROJECT NORTH
DESIGNED S. HOLMES
DRAWN L. EVEN
CHECKED
APPROVED
SUBMITTED
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
MAIN INJECTOR PROJECT
ALTERNATIVE SITE PLAN
FIGURE 2.2.2.1

This alternative site has significant disadvantages over the proposed site which would impact Fermilab's ongoing high-energy physics program. First, the circumference of the FMI would be about 500 meters greater than in the proposed site, substantially increasing construction costs. Second, because of the convergent, rather than divergent, nature of the beamlines, total length of required beamlines would be longer in this case and the number of dipole magnets would increase. The convergent nature of the beamlines would also complicate the design of the FMI injection into the Tevatron.

Finally, the interfaces between the beamlines and existing enclosures occur in the area occupied by the existing Main Ring/Tevatron utility corridor. Constructing the FMI inside the Tevatron would mean digging up sections of the utility corridor during certain FMI construction phases. This would result in a much larger impact on Fermilab's ongoing operations than would the proposed siting, adding several months to the interruption of the Fermilab research programs as well as creating the potential for major unscheduled disruptions.

2.2.2.2 Construction at alternative sites not immediately adjacent to the Tevatron. Most of the land not immediately adjacent to the Tevatron cannot be used for the proposed FMI because such land either currently contains buildings and other Fermilab equipment or is not large enough for the project. The Booster and the Antiproton Source are located to the west and southwest of the Tevatron. Fermilab's office building and fixed-target experiment areas are located to the west and northwest of the Tevatron. The area south of the Tevatron is not large enough for the proposed FMI because of the close proximity of Butterfield Road. Consequently, only the areas to the east and northeast are possible alternative locations for construction of the FMI.

The property that is located northeast of the Tevatron and east of the Tevatron could be considered as possible sites for the FMI if multiple interconnections of the accelerator were not required. Construction of the FMI at these sites would clearly be impracticable because Fermilab's existing beamlines could not be used. Also at these locations, it is not technically feasible to design the very long beamlines that would be required to link the FMI with the Booster and Antiproton Source in order to transfer protons and antiprotons into the FMI for acceleration. Furthermore, inordinately long beamlines would be needed to link the FMI with the Tevatron. Insight into the technical difficulties associated with long beamlines is achieved by understanding that there are many requirements which must be accurately matched. The problem is not just transferring a few particles from one accelerator to another, but involves intense beams of particles that arrive at the input of the receiving accelerator at an exact position pointing in the right direction with a precise velocity distribution and compacted into a highly confined space. The properties of the array of accelerators that constitute the Tevatron were determined over the years since Fermilab was established. The proposed FMI therefore must conform to the already given parameters of the accelerators and their interconnecting beamlines. The technical limitations of long beamlines eliminate locations not immediately adjacent to the Tevatron as reasonable alternatives.

2.2.2.3 Alternative configurations to minimize consequences. As discussed in Section 4.1.3.2.2, DOE undertook a comprehensive design study of the proposed construction site and FMI configuration to minimize environmental consequences. In the proposed construction plan, modifications were made to the Main Injector Road, the cooling ponds, and the shielding berm to decrease the amount of wetlands that would be disturbed and to minimize the disturbance of vegetation in Wetland Number 4.

2.2.2.4 Other DOE facilities. No existing DOE facility is capable of conducting the experiments which would be performed at Fermilab after the FMI becomes operational. Although there may appear to be a logical entry for the case of modification of other DOE facilities in order to accomplish the experiments that would be done by the Tevatron when the Main Injector improvement is incorporated, such is not the case. That is, it is not practical to modify the AGS from 30 GeV to 1 TeV. Only by building an entirely new 4-mile circumference accelerator at BNL could one propose to do the experiments that are proposed at Fermilab with the proposed FMI. Under current costs if detectors are included this would require approximately $1 billion. In addition the land is not available since BNL is surrounded by housing and manufacturing areas. Likewise the Stanford Linear Accelerator facility is an electron-positron facility, and is not upgradeable to colliding beams of 1 TeV protons and antiprotons.

The experiments that will be performed at Fermilab using the Tevatron after the FMI upgrade are designed to exploit the properties of the Tevatron. New accelerators such as the Relativistic Heavy Ion Accelerator at BNL scheduled for completion in FY97 and the SSC in Texas scheduled for completion in FY99, have research programs that are planned to exploit the unique opportunities which become available when these new accelerators are brought into operation, such as heavy ions at BNL and the 20 TeV energy of the SSC. Even though it is possible in the case of the no action alternative that some FMI experiments might be performed at the SSC, among the most obvious disadvantages are (1) the results would be available several years later and (2) there would be less time available for the SSC's main experimental theme.

CHAPTER 3

THE AFFECTED ENVIRONMENT

3.1 SITE DESCRIPTION

Fermilab is located about 30 miles west of downtown Chicago, as shown in Figure 3.1, in western DuPage and eastern Kane Counties. According to preliminary 1990 census data, 781,666 people live in DuPage County and 317,471 live in Kane County. Waterways, railroads, highways and nearby universities are also shown in that figure. Interstate 88 to the south is the dominant east-west road. Illinois Route 59 is just east of the site running north-south.

The laboratory site of 6,800 acres is located in a mixed use area of farmland, residential, and business park. Immediately to the east is the town of Warrenville (11,333 population), to the west is Batavia (17,076 population), to the north is West Chicago (14,796 population), and to the south is Aurora (99,581 population).

The 135-acre site for the proposed FMI construction is south of the Antiproton Source in the southwest corner of the Fermilab site and tangent to the Tevatron ring at the F0 straight section as shown in Figure 2.1.1.2. This area is entirely within the existing Fermilab site. The construction site is mainly open grassland with all farm tracts removed from leased cultivation beginning with the 1989 crop year. The overall drainage pattern is to the southwest into Indian Creek. There are isolated areas of trees and fence rows, shallow ditches meander the site, and abandoned agricultural earthenware pipe used for drainage can be seen occasionally. No endangered plant species or animals are known to be present in the area of the proposed construction. In 1985, Fermilab discovered that a small stand of dead timber inside the proposed FMI provided a nesting habitat for great blue herons. The herons abandoned this site in 1991 and moved to a site inside the Main Ring. (See Section 4.1.7.1 for further discussion.) The area for the proposed 345 kV transmission line is mainly open cropland with rows of trees and bushes. AB-5 would be located in Fermilab's Industrial Area.

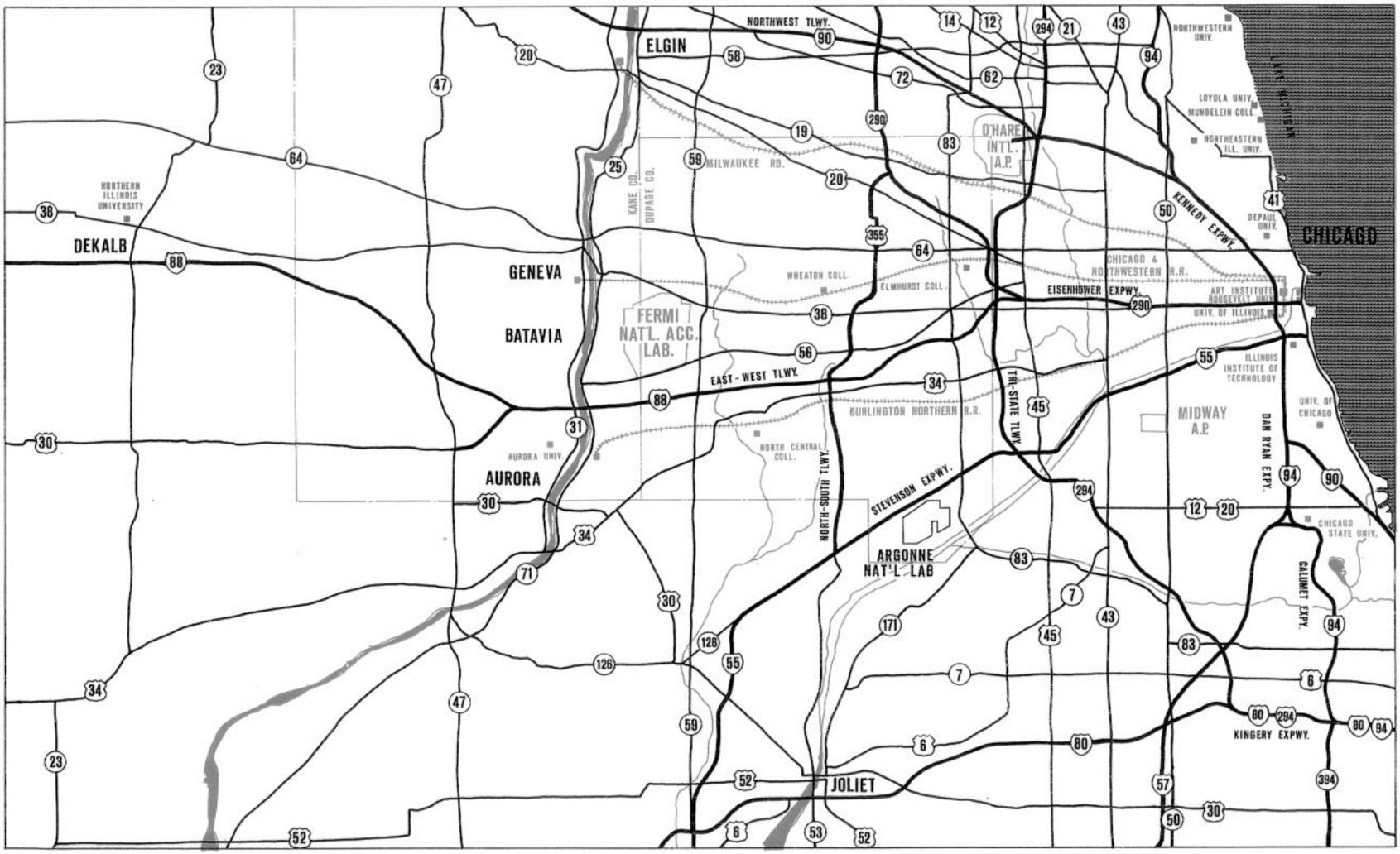
3.2 CLIMATOLOGY AND AIR QUALITY

3.2.1 Climatology

The regional climate around the proposed FMI site is characterized as being continental, with cold winters and hot humid summers (DOE 1982), and is slightly modified by Lake Michigan (Denmark 1974). There are frequent short period fluctuations in temperature, humidity, wind direction and speed.

Weather data for the Fermilab area are reported in the SSC Site in Illinois Proposal. The average daily high temperatures at Fermilab in January is 28.9°F and the average daily low is 11.3°F. July is normally the warmest month with average daily high of 84.2°F and average daily low of 61.9°F. In about half the summers, 99°F has been exceeded. Half the winters have had a minimum as low as -10°F. The lowest recorded temperature was -27°F in 1985.

The predominant wind direction is from the south, and wind from the southwest quadrant occurs almost 50% of the time. The average wind speed at Fermilab at a height of 19' is 7.6 mph, with calm periods occurring 3.1% of the time.



REGIONAL MAP
FIGURE 3.1

The average annual precipitation at Fermilab is 33.3" and about 2/3 of this, falling between April 1 and September 3, is associated with thunderstorms. The annual average accumulation of snow and sleet at Fermilab is 32.7". Snowstorms resulting in accumulations greater than 5.9" occur only once or twice each year on the average, and severe ice storms occur only once every 4 or 5 years (Denmark 1974).

The area experiences about 40 thunderstorms annually (NOAA 1980). Occasionally, these storms are accompanied by hail, damaging winds, or tornadoes. From 1957 to 1969 there were 371 tornadoes in the state, with more than 65% occurring during the spring months (NOAA 1970). The theoretical probability of a 150-mph tornado strike at Fermilab is 15.8×10^{-5} each year, a recurrence interval of one tornado every 6,285 years. The Fermilab site has experienced no tornados but it has experienced severe storms that caused minor damage to power lines, roofs, and trees.

The climatology information is presented because of its use in building designs that will resist wind speeds experienced in thunderstorms, and in computer modeling of airborne radiation emissions.

3.2.2 Air Quality

National and state air quality standards for criteria pollutants are listed in Table 3.2.2.

Monthly and composite gaseous pollutant averages from a January 1979 through April 1980 air quality study at Fermilab showed that all pollutants except ozone and reactive hydrocarbons were in compliance with National and Illinois Ambient Air Quality Standards. Because Fermilab is in the metropolitan Chicago area, ozone exceeded the state standard on 22 days, but the federal standard was exceeded only once; reactive hydrocarbons exceeded the standard for non methane hydrocarbons (which is a larger class) on 10 days. Fermilab's operations do not significantly contribute to these exceedances. Values found for particulates were all within the primary and secondary maximum standards.

High energy particle accelerators emit small amounts of airborne radionuclides as a part of their normal operations. All possible sources of accidental airborne releases are negligible. As discussed in Chapter 2, radionuclide emissions are subject to NESHAP standards contained in 40 CFR 61 Subparts A and H. Section 61.92 of Subpart H limits radionuclide emissions to the public from DOE facilities to 10 mrem/yr. A comprehensive annual air sampling program has been in effect since 1972 to monitor radioactive air quality. The results are documented in Fermilab's annual "Site Environmental Report."

The 1989 Environmental Report concentrates on normal emissions from the target used to produce antiprotons. This target was a source of radioactive gas resulting from interaction in air of secondary particles leaving this target. Because this target is heavily shielded and the air volume is small, there are many thermal neutrons also radioactivating the air. The result is a mixture of primarily ^{11}C and ^{41}Ar with small amounts of ^{13}N, ^{38}Cl, and ^{39}Cl in air. The ^{41}Ar has a half-life of 1.8 hours and is produced by neutron capture in ^{40}Ar. Air contains about 1% argon which is essentially ^{40}Ar. Interaction of high-energy secondary particles with nitrogen and oxygen in the air produces 20 minute half-life ^{11}C and 10 minute half-life ^{13}N. Interaction of high energy neutrons with argon in the air is probably the source of 37 minute half-life ^{38}Cl and 58 minute half-life ^{39}Cl (Butala 1989).

Table 3.2.2 Summary of national and Illinois ambient air quality standards[a]

Pollutant	Time of average[b]	Primary standard (at 25°C and 760 mm of Hg)	Secondary
Particulate matter (PM_{10})[c]	Annual geometic mean Max. 24-hour concentration mean	Illinois: 75 $\mu g/m^3$ National: 50 $\mu g/m^3$ 260 $\mu g/m^3$ 150 $\mu g/m^3$	60 $\mu g/m^3$ 150 $\mu g/m^3$
Sulfur dioxide ($S0_2$)	Annual arithmetic mean Max. 3-hour concentration Max. 24-hour concentration	0.03 ppm (80 $\mu g/m^3$) 0.14 ppm (365 $\mu g/m^3$)	0.5 ppm (1300 mg/m^3)
Carbon monoxide (C0)	8 hour average concentration	9 ppm (10 mg/m^3)	Same as primary
	1 hour average concentration	35 ppm (40 mg/m^3)	Same as primary
Photochemical oxidants (0_3)	Max. 1 hour concentration	0.12 ppm (235 $\mu g/m^3$)	Same as primary
Nitrogen dioxide ($N0_2$)	Annual arithmetic mean	0.05 ppm (100 $\mu g/m^3$)	Same as primary
Lead (pb)	Quarterly arithmetic mean	1.5 mg/m^3	Same as primary

[a]Illinois standards are identical to national standards, except where indicated.

[b]All standards are averaging times of 24 hours or less are not to be exceeded more than once a year.

[c]Particles with an aerodynamic diameter under 10 microns.

The total release was 82 Ci from the Antiproton Area Stack during normal colliding beam operations.

In 1989, a typical year of operations, Fermilab calculated site boundary concentrations using the computer program AIRDOSE-EPA (Moore et al. 1979) (Moore et al. 1986) (a gaussian plume diffusion model). Wind conditions for O'Hare Airport, about 27 miles away, were used as input. The terrain between Fermilab and the airport is relatively flat. The maximum dose equivalent to an individual member of the general population for 1989, due to the source, was 0.02 mrem. This is 0.5% of the 10 mrem/yr dose limit currently in effect. These results are typical of those obtained by modeling all such radionuclide emission stacks at Fermilab. This is due to the fact that all stacks which release radionuclides have similar radionuclide compositions since the production mechanisms are the same at each and also stack geometries are similar. The total activity released from each of these stacks is continuously measured using calibrated Geiger-Mueller tube instruments. Stack heights are typically 3 to 8 meters above grade. Climate data from O'Hare International Airport was also used. Worst case assumptions for vertical deposition and scavenging coefficient are used.

3.3 Work Force

After the selection of the site in Kane and DuPage Counties of Illinois for Fermilab in December 1966, there was an influx of scientists and engineers from all over the United States and even a few from overseas. Figure 3.3.1 shows the distribution of the Fermilab staff by county of residence as of 1990. As can be seen in the figure, the largest concentration of employees reside in Kane County. Since a 50-mile radius from Fermilab includes the Chicago metropolitan area, more than 8 million people reside inside a circle drawn with that radius where Fermilab is the center.

The closest residences to the proposed FMI site are three farm houses across the Illinois Prairie Path in the triangle formed by Butterfield Road on the south, Kirk Road on the west and the Prairie Path which crosses Butterfield Road with a northwest heading. One of these houses is currently abandoned. These houses are identified on the US. Geological Survey map in Figure 3.3.2. The farm house that is closest to the proposed site is approximately 1/2 kilometer distant. All other residences are at least one kilometer from the site. A list of adjoining and potentially affected property owners is given in Appendix B.

3.4 ARCHAEOLOGICAL AND HISTORIC RESOURCES

Pursuant to 36 CFR Section 800.13, which implements Section 106 of the National Historic Preservation Act (16 U.S.C. Section 470f), DOE has examined the proposed construction site to determine whether FMI construction would have an effect upon archaeological resources potentially eligible for the National Register of Historic Places (NRHP) and has undertaken consultation with the Illinois State Historic Preservation Officer (ISHPO). Phase I testing has been performed on the entire Fermilab site, including the proposed FMI construction site. There are no historic architectural structures that would be affected by the proposed construction. Fermilab employed an archaeological consultant to survey the proposed construction area and to prepare a report to the ISHPO concerning whether identified sites are eligible for the NRHP.

FERMILAB EMPLOYEE DISTRIBUTION

BY COUNTY OF RESIDENCE

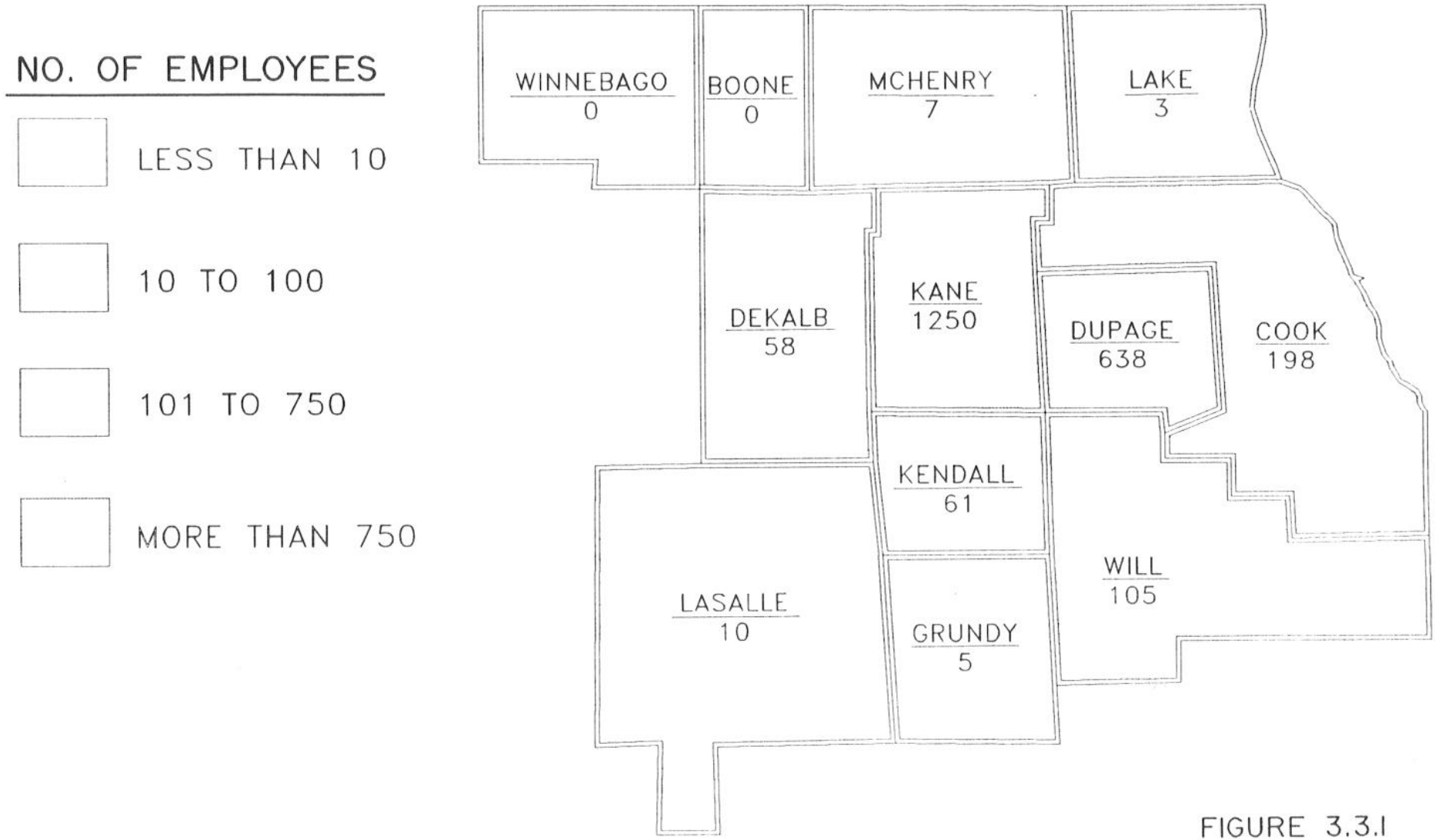
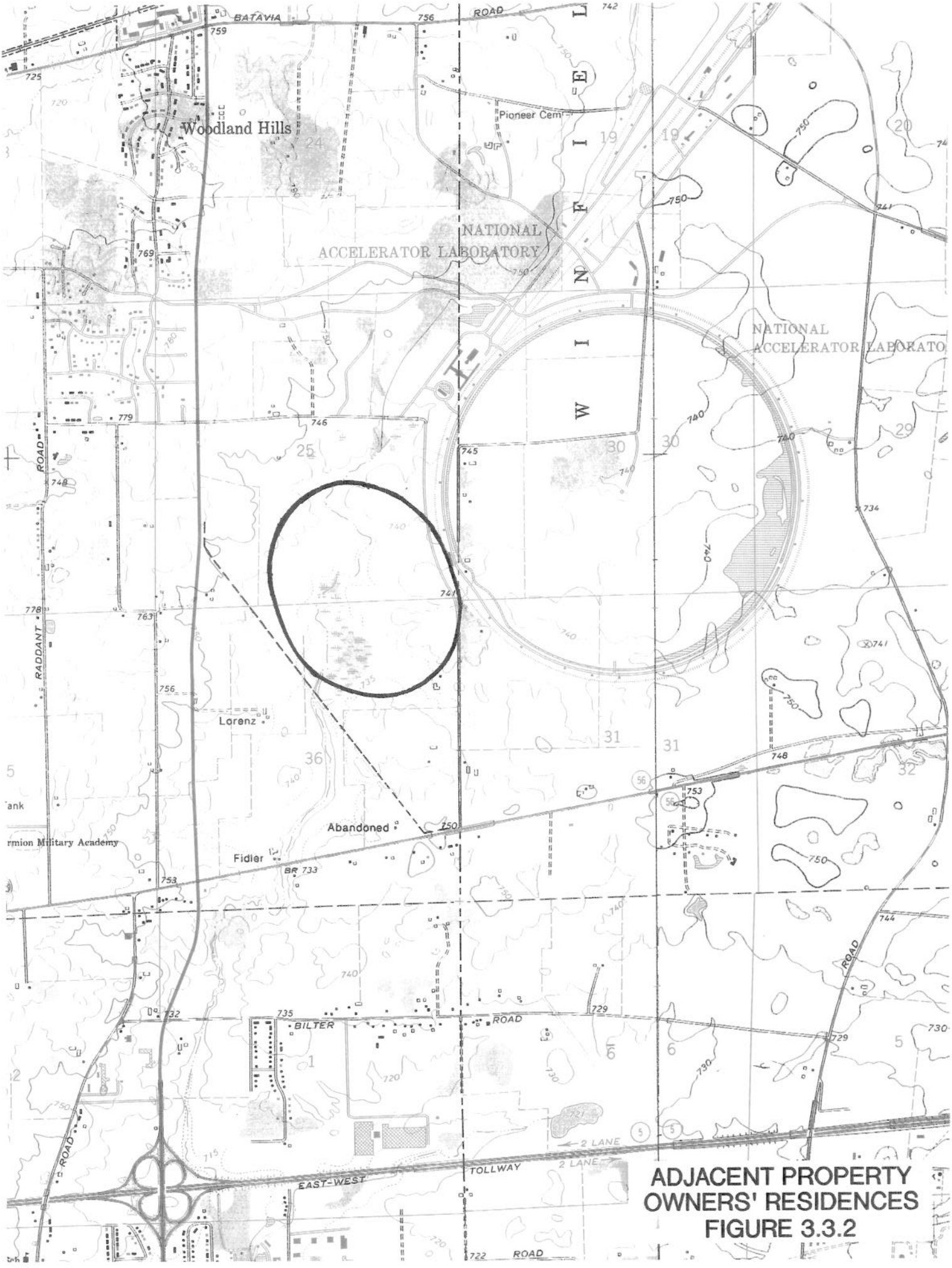


FIGURE 3.3.1



ADJACENT PROPERTY OWNERS' RESIDENCES
FIGURE 3.3.2

3.4.1 Prehistoric Archaeological Resources

Three archaeological areas, Tadpole, Pioneer and Lorenz, have been identified in the vicinity of the proposed FMI site. (See Figure 3.4.1.) Figure 3.4.1 shows the location of these areas in relation to the proposed FMI. Tadpole, an Archaic area, is located immediately to the northwest of the proposed FMI site. This area was identified in 1970. and is located on a small rise with a swampy area to the west. Artifacts were found along the boundary of the plowed field and the unplowed pasture area to the north. In 1988 the archaeological consultant shovel tested the pasture and found no cultural material. The consultant determined that no further testing was required. This area is now covered by grass and trees.

The consultant also evaluated the Pioneer area, which is located to the southeast of the proposed FMI, and found it to be ineligible for the NRHP. It further concluded that no further testing was required.

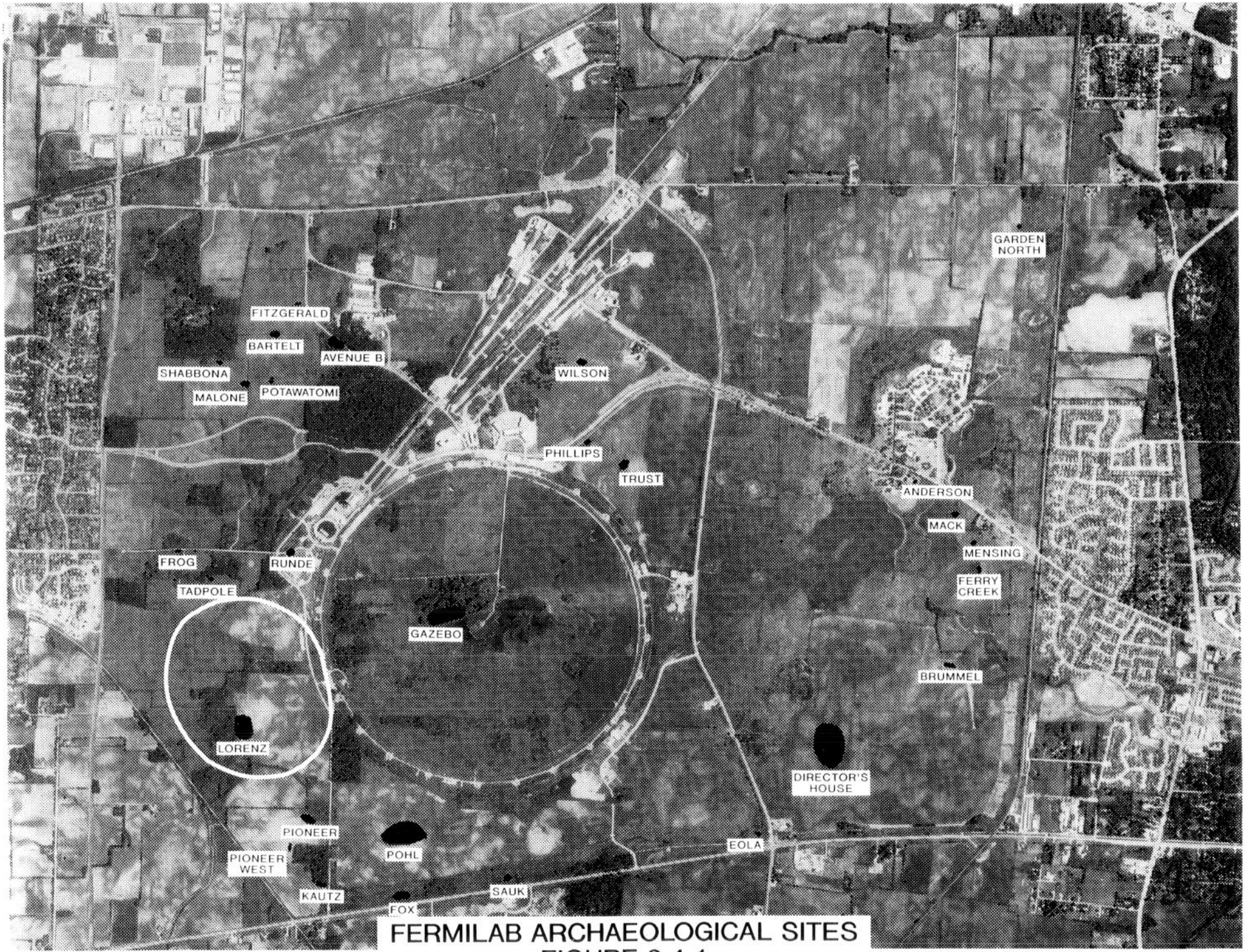
The Lorenz area, an Archaic/Mississippian area, is located inside what would be the center of the FMI. This area was identified as having a low density of cultural material, although some was recovered from a 1-acre area. This area was tested further by Fermilab's archaeological consultant in 1987, but very little material was recovered and all that was collected had been contained in the plow zone. The consultant also shovel-probed unplowed areas adjacent to the Lorenz area but found no cultural material. It was the opinion of Fermilab's consultant archaeologist that it is unlikely that any part of the area remains intact (Lurie 1990). The area was determined to be ineligible for the NRHP and no further testing was required.

3.4.2 Collector Finds

When collectors were interviewed in 1989, they identified 4 collector finds that would be traversed by portions of the proposed FMI and the KMS. These are indicated as numbers 2, 13, 15 and 16 in Figure 3.4.2. Collector Find 13 was surveyed in 1989 and subsequently the ISHPO determined the Find to be ineligible for NRHP. Surveillance and testing in the summer of 1990 determined that Collector Find 16 actually contained three distinct prehistoric finds. All of these areas were tested and none has indications of intact cultural deposits. Fermilab's consultant archaeologist determined that these finds are not eligible for the NRHP. In March 1991, DOE requested the Illinois Historic Preservation Agency to concur in the determination of ineligibility for Collector Find 16. In June 1991, Fermilab's archaeological consultant evaluated Collector Finds 2 and 15 (Figure 3.4.2). Based upon this evaluation, It concluded that these areas are NRHP-ineligible. In June 1991, DOE requested the Illinois Historic Preservation Office to concur in this determination. In July 1991, the Illinois Historic Preservation Office concurred in the determination that Collector Finds 2, 3, 13, 15, and 16 were NRHP-ineligible. (As evidenced by Figure 3.4.2, Collector Find 3 would not be affected by the proposed FMI construction.)

3.4.3 Historic Cultural Resources

This area of Illinois was only sparsely settled by Euro-American populations before 1830. In Kane County, the first settlers established themselves near the Fox River. Farming was concentrated in the uplands area and extended into the prairies. Early in the



FERMILAB ARCHAEOLOGICAL SITES
FIGURE 3.4.1

FERMILAB ARCHAEOLOGICAL AND COLLECTOR SITES
FIGURE 3.4.2

1900s drainage districts were organized and drain tiles were installed in the remaining prairie to make it suitable for agriculture. Evidence of abandoned agricultural earthenware pipe used for this purpose can be seen in old fields throughout the site. Preliminary results of research by consultant historical archaeologists identify farmsteads as early as 1841 on what is now the Fermilab site. A historical survey of previously recorded sites and potential sites as defined by an 1862 map has just been completed. None of these sites under investigation is within the proposed construction area. However, in the summer of 1990, during the survey of the prehistoric Collector Find 16, historic artifacts found scattered throughout the field resulted in the discovery of two previously unknown historic sites. To date there is no evidence of NRHP eligibility for any of the historic sites. DOE's March 1991 submittal to ISHPO also requested concurrence in this determination. In July 1991, ISHPO concurred on the determination of NRHP ineligibility.

3.5 GEOLOGY

3.5.1 Stratigraphy and Soils

According to soil boring logs and well drilling reports, the Fermilab site is underlain by 65' to 80' of glacial till (Wisconsin stage of the Pleistocene series). Lineback (1979) mapped this unit as the Wadsworth Till Member of the Wedron Formation and described it as a clayey to silty-clayey till with few pebbles and cobbles. Sasman et al. (1981) observed, however, that the base of this unit is locally rich in gravel. Gravel deposits are probably confined to valleys carved in the bedrock surface, which now lies buried beneath the Pleistocene sediments (alluvium and glacial till). The till is overlain by from 1' to 4' of modern soil. Strata immediately underlying the till probably belong to the Niagara Formation of the Alexandrian Series, lowermost Silurian System. The subcropping weathered zone is up to 35' thick. This zone shows significant evidence of solution weathering and fracturing below which rock is generally unfractured and unaltered.

According to USDA (1979), the Fermilab site consists mainly of nearly level upland soils belonging to the Wauconda Series with well-drained areas of soil of the Zurich Series, and poorly drained pockets of soils belonging to the Drummer Series. The Wauconda and Zurich soils formed in calcareous, silty material and the underlying, stratified loamy outwash. The Drummer soils formed in silty material and the underlying, stratified outwash. In the proposed FMI construction area, surfaces on these soils generally range from nearly flat to about 5% slope. These upland soils are deep, well drained, and moderately slow to slowly permeable.

Other soil series in and adjacent to the proposed construction site are the Morley (silt loam) and Milford (silty clay loam) to the north and west. The Morley series soils are generally well drained; the Milford soils are poorly drained and are in localized low-lying areas within the upland till plain. The Beecher (silt loam) and Morley series border the southerly edge of the site. The Beecher Series soils are somewhat poorly drained and are located on flats and drainageways. There are isolated areas of Grays and Mundelein silt loam soils, Peotone silty clay loam and Muskego and Houghton mucks in the easterly areas of the Indian Creek drainage basin. The Grays soils are moderately well drained while the Mundelein soils are somewhat poorly drained and the Peotone soils and the mucks are very poorly drained and are in depressions and along streams. Table 3.5.1 summarizes soil characteristics and Fig. 3.5.2 is a map of soil types in the vicinity of the proposed FMI.

Table 3.5.1 Soil types in the vicinity of the FMI site (USDA 1979)

Numbers[a]	Series[a]	Texture Classification	Characteristics	Buildings with Basements; Site Development Restrictions	Site	Soil and Water Features: Development Restrictions
69	Milford	Silty Clay Loam	Level or nearly level, poorly drained soil on upland flats and in depressions. Flooded briefly in spring.	Severe: Wetness, shrink swell floods.	F WT FA C	Occasional, brief 0-2.0 ft. apparent High High, low
152	Drummer	Silty Clay Loam	Level or nearly level, poorly drained soil on upland flats, in drainageways and in depressions on outwash plains and on end and ground moraines. Occasionally flooded briefly in spring.	Severe: Wetness, floods.	F WT FA C	Occasional, brief 0-2.0 ft. apparent High High, moderate
194B	Morley 2-5% slopes	Silt Loam	Formed in glacial till. Gently sloping, well-drained & moderately well drained soil is on convex ridgetops, side slopes and knowlls. Slowly permeable.	Moderate: Shrink-swell, wetness.	F WT FA C	None 3.0-6.0 ft. perched Moderate High, moderate
298	Beecher	Silt Loam	Nearly level to very gentle sloping, somewhat poorly drained soil is on flats & drainageways. Slowly permeable.	Severe: Wetness.	F WT FA C	None 1.0-3.0 ft. perched High High, high
330	Peotone	Silty Clay Loam	Nearly level, very poorly drained soil . Is in depressional areas on uplands that receive sediment from surrounding slopes. Occasionally flooding for long periods in spring. Slowly permeable.	Severe: Wetness, Floods, Shrink-swell.	F WT FA C	Occasional, long 0-1.0 ft. perched High High, moderate
442	Mundelein	Silt Loam	Nearly level, somewhat poorly drained soil. Is on very low ridges or knolls and in shallow depressions on outwash plains and on slight rises near drainage-ways.	Severe: Wetness.	F WT FA C	None 1.0-3.0 ft. apparent High High, moderate

Table 3.5.1 Soil types in the vicinity of the FMI site (USDA 1979) cont'd

Numbers[a]	Series[a]	Texture Classification	Characteristics	Buildings with Basements; Site Development Restrictions	Site	Soil and Water Features: Development Restrictions
696B	Zurich 2-5%	Silt Loam	Moderately well drained soil. Is on undulating knolls and ridges on outwash plains or on gently sloping lower side slopes in the uplands.	Moderate: Shrink-swell, wetness	F WT FA C	None 4.0-6.0 ft. apparent High Moderate, moderate
697	Wauconda	Silt Loam	Nearly level, somewhat poorly drained soil is on low ridges and knowls or in shallow depressions on outwash plains.	Severe: Wetness.	F WT FA C	None 1.0-3.0 FT. apparent High High, moderate
698B	Grays 2-5% slopes	Silt Loam	Gently sloping, moderately well drained soil is on undulating out-wash plains and benches along streams.	Moderate: Wetness, shrink-swell	F WT FA C	None 4.0-6.0 ft. apparent High Moderate, moderate
903	Muskego & Houghton	Muck	Level, very poorly drained soils are in depressions on uplands and along streams. Formed in fibrous plant remains deposited in marshy areas. Frequently flooded for long periods in winter and spring.	Severe: Wetness, low strength, floods	F WT FA C	Frequent, long 0-1.0 apparent High High to moderate, Moderate to low

F Flooding
WT Water Table
FA Frost Action
C Corrosion[b]
a: Refer to Fig. 3.5.1 for location of soil series as identified on map by number.
b: Corrosion potential for uncoated steel and concrete respectively.

MAIN INJECTOR AREA SOIL TYPE MAP

SLOPE DESIGNATIONS

UNLETTERED	0 TO 2%
A	2 TO 5%
B	5 TO 10%
C	7 TO 15%
D	> 15%

EROSION CLASSIFICATION

UNNUMBERED	UNERODED
2	ERODED
3	SEVERELY ERODED

SOIL TYPES

SEE TABLE 3.5.1

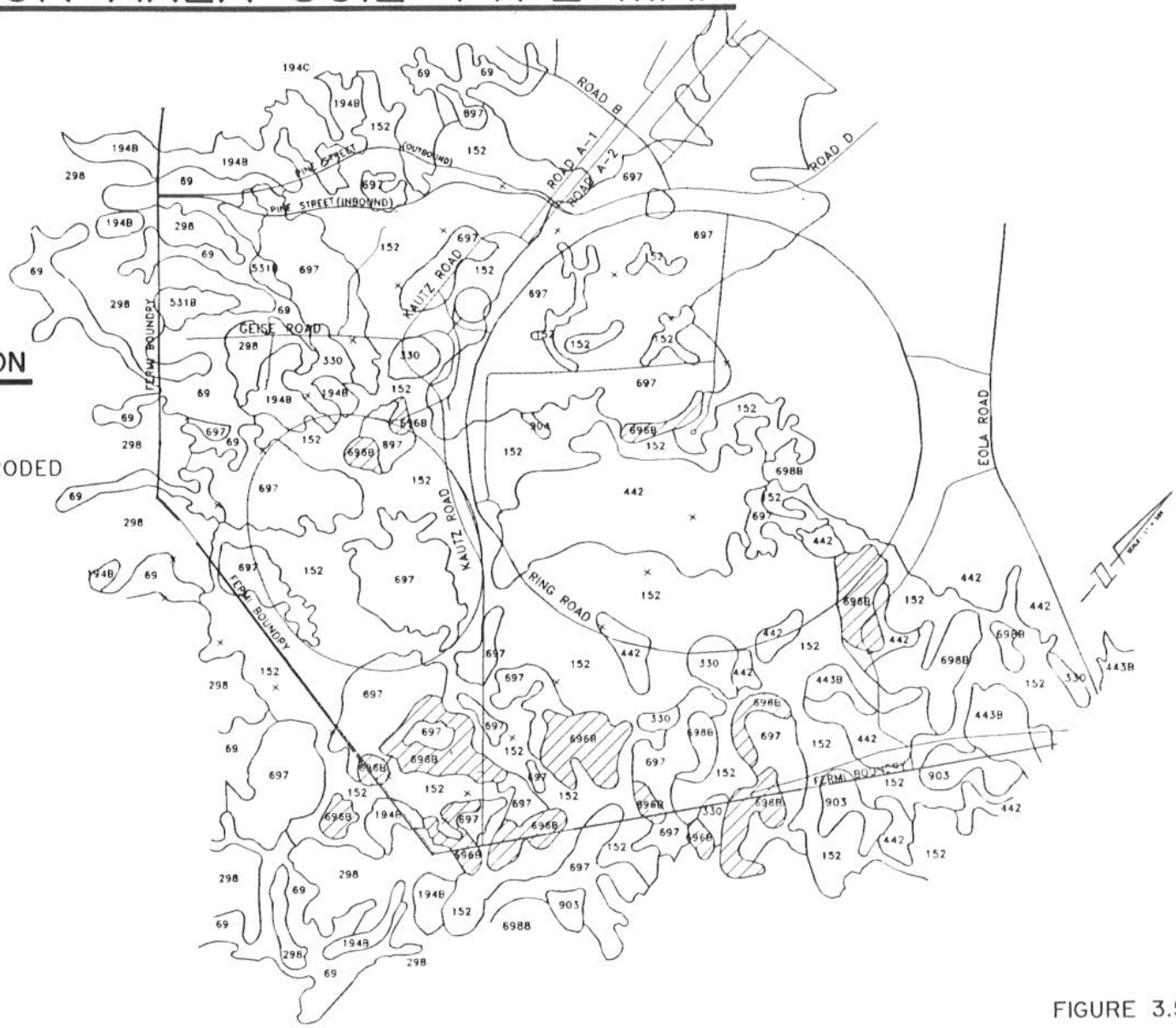


FIGURE 3.5.2

During accelerator operations, radioactivation of soils occurs in target and beam loss areas on the Fermilab site. These areas are designed to minimize the amount of soil that becomes activated. As a result, Fermilab has sampled soils for accelerator-produced radionuclides to assess the possibility that groundwater supplies have been contaminated with these radionuclides from activated soils. As discussed in Section 3.7, these studies have shown that accelerator operations have not resulted in activation of soils that have the potential to contaminate groundwater either on the Fermilab site or beyond it. The soils at Fermilab are not anticipated to contain abnormal concentrations of naturally-occurring radionuclides and no such abnormal concentrations have been identified.

3.5.2 Seismicity

The proposed FMI site has been evaluated to have minor seismic risk and is classified as UBC Seismic Zone 1. No tectonic features within 62 miles of Fermilab are known to be seismically active. The longest of these features is the Sandwich Fault. Smaller local features are the Des Plaines disturbance, a few faults in the Chicago area, and a fault of apparently Cambrian age (DOE 1982).

Although a few minor earthquakes have occurred in northern Illinois, none has been positively associated with a particular tectonic feature. Most of the recent local seismic activity is believed to be caused by isostatic adjustments of the earth's crust in response to glacial loading and unloading, rather than by motion along crustal plate boundaries.

There is one area of considerable seismic activity at a moderate distance (hundreds of kilometers) from Fermilab. This is the New Madrid fault zone in southwestern Missouri. Although high-intensity earthquakes have occurred along the New Madrid fault zone, their relationship to plate motions remains speculative at this time.

According to estimates by Algermissen et al. (1982), ground motions induced by near and distant seismic sources in northern Illinois are expected to be minimal. However, peak accelerations in the Fermilab area may exceed 10% of gravity (approximate threshold of major damage) once in about 600 years, with an error range of -250 to +450 years (Coats and Murray 1984). Nonetheless, no special design considerations are required as a result of seismicity.

3.6 LAND USE

3.6.1 Site

The proposed FMI construction site is in an undeveloped area of the Fermilab property and currently consists of formerly leased farm tracts planted primarily in corn, old fields of non-native grasslands, remnant woodlands, forested wetlands, and a prairie reconstruction tract seeded in 1984. The proposed FMI site lies in Kane County, with the transmission line extending into DuPage County. The proposed FMI site was primarily farmland before federal acquisition and the 1982/1990 Kane County Comprehensive Land Use Plan designates the proposed FMI site as Institutional Private Open Space. All of the farm tracts in the FMI area were taken out of production in 1989. The proposed AB-5 would be built adjacent to Fermilab's Industrial Area in DuPage County.

3.6.2 Vicinity

When early settlers arrived in this area in the early-to-mid-nineteenth century, they found a woodland/prairie mosaic. As the area was settled, agricultural use intensified in the upland areas adjacent to Fermilab. Area land use at the time of purchase of land for Fermilab was primarily cash grain cropping and cattle raising. Scattered patches of mixed hardwood timber, fence-row plantings, and small brushy and marsh communities were interspersed on the landscape. In addition, the village of Weston occupied land near the eastern boundary of the site. Today the on-site land uses immediately adjacent to the proposed FMI site consist of a 4-mile underground accelerator ring to the east, open land including prairie reconstruction projects, currently leased farm tracts, and old fields in various successional stages elsewhere. Off-site land surrounding the Fermilab site is mostly residential with some small farms and commercial activities. DuPage County has zoned the property adjacent to Fermilab as R-2, single family residential. There is no zoning of the property in Kane County adjacent to Fermilab.

3.7 GROUNDWATER

The hydrologic setting for the Fermilab area includes unconsolidated glacial drift overlying indurated sediments consisting of dolomites, shales and sandstones. The hydrologic controls and the flow mechanisms are porous media flow in the glacial drift, fracture and dissolution flow in the dolomites and shales, and predominantly porous media flow in the sandstones.

There are four major aquifer systems in northeastern Illinois. The Mt. Simon and Elmhurst sandstones form the lowermost aquifer and is roughly 2230' thick. It is capped by the low-permeability dolomite and dolomitic siltstone. The locally utilized Cambrian-Ordovician aquifer is located above the siltstone and consists of sandstones and dolomites and lies between 240' and 790' and 1500' beneath the surface. This aquifer system is capped by the Maquoketa shale and dolomitic siltstone formation. The other primary local water source is the shallow Silurian age Niagara Dolomite aquifer which lies roughly between 65' and 225' beneath the surface. The base of the glacial materials contains sand and gravel forming the fourth aquifer system. These upper two aquifers are hydraulically linked and are used as the primary water supplies at Fermilab. Fermilab's Village is connected to the Warrenville water supply network.

As presented earlier, the Fermilab site has thick glacial till consisting primarily of low permeability clay. The water table in the glacial deposits is typically 1 to 3 m below the surface. Percolation rates for water in Fermilab soils are calculated to be very low--less than 1 m per year. (Schicht and Wehrman, 1978.) From Fermilab, groundwater flows southwest toward the Fox River and southeast toward the West Branch of the DuPage River as shown on Figure 3.7. At the proposed FMI site, groundwater flows toward the Fox River.

3.7.1 Use

The drinking water in many of the surrounding communities comes from deep wells usually drilled 1200' deep into the Cambrian/Ordovician aquifer system. The upper part of the Mt. Simon-Elmhurst aquifer is penetrated by numerous wells that are also open to the Cambrian-Ordovician aquifer causing upward flows from the lower. Hundreds of deep wells with heavy pumpage in Fermilab's surrounding areas have resulted in the decline in the piezometric surface of the Cambrian-Ordovician aquifer. The Silurian aquifer

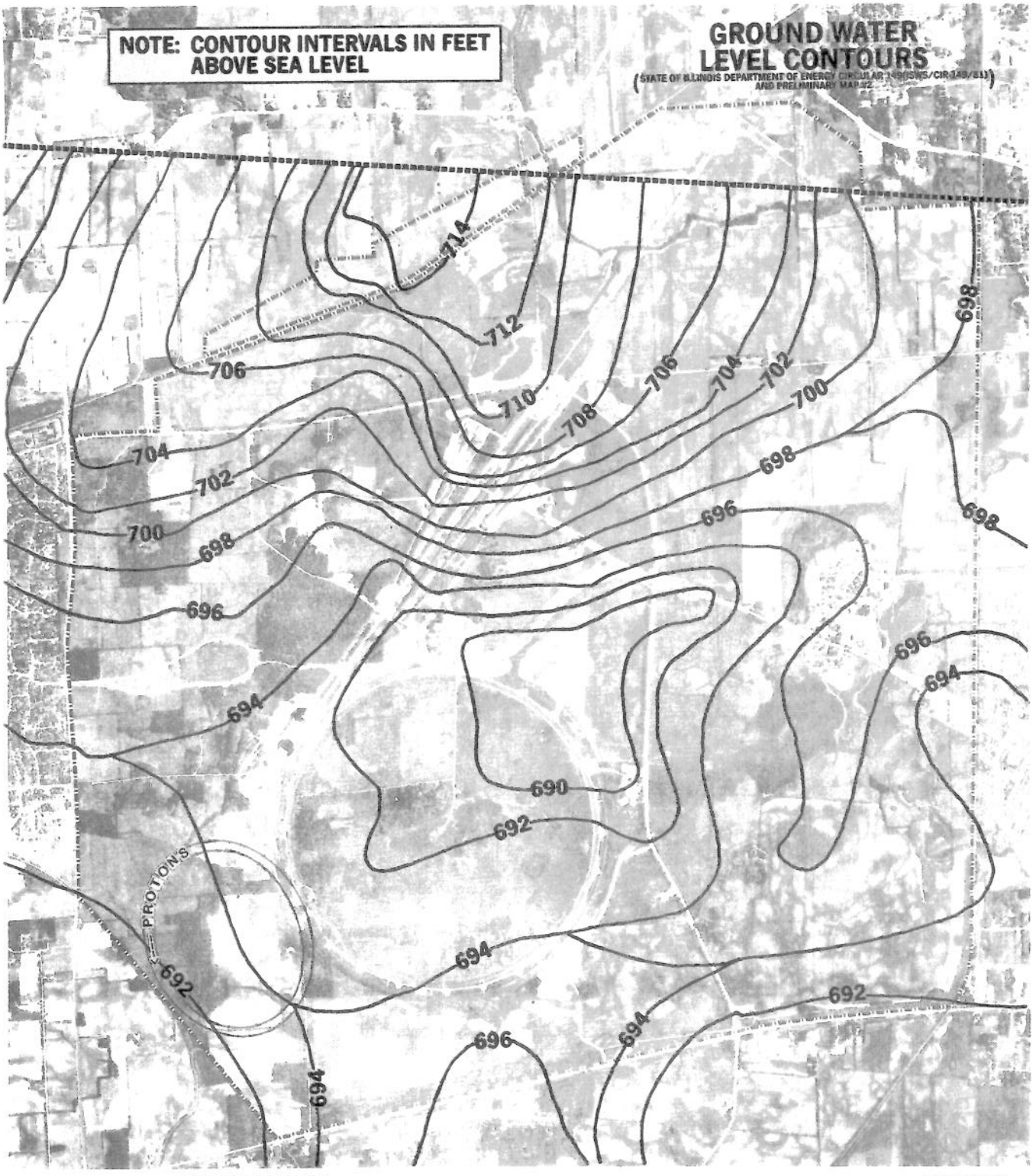

NOTE: CONTOUR INTERVALS IN FEET ABOVE SEA LEVEL
GROUND WATER LEVEL CONTOURS
(STATE OF ILLINOIS DEPARTMENT OF ENERGY CIRCULAR 149(ISWS/CIR-149/81) AND PRELIMINARY MAPS)
714
712
706
710
708
706
704
702
700
698
704
702
700
698
696
698
696
694
696
694
690
692
PROTON'S
692
694
696
694
692
694
OVERLAY FOR BASE 4, FERMILAB
0 250 METERS 750 1000 1250
0 1000 FEET 3000 4000
BASE 4
FERMI NATIONAL ACCELERATOR LABORATORY
41 50 30 N 88 14 30 W
(SITE CENTER)
PHOTO DATED JUNE 1988
PREPARED IN 1989
PREPARED IN 1989
FOR DOE
BY EG&G

FIGURE 3.7

is heavily used as a water supply source in DuPage, Cook, Kane and Will Counties. It is most heavily pumped in DuPage County where the estimated 1984 pumping rate was 200,000 m^3/day (54.6 MGD). Also, there are many individual private wells drilled into the shallow Silurian aquifer system at around 100' below the surface. In recent years, the use of this aquifer has decreased as a result of water being obtained from Lake Michigan and the Fox River.

The primary source of drinking water on the Fermilab site is also the Silurian aquifer. Wells 1 and 3 (Figure 3.7.1) are the main wells and collect water from 65' to 200' below the surface. Well 1 is located in the Central Laboratory area and Well 3 is located near Road B to the north. Well 3 supplies water to the site when demand exceeds the capacity of Well 1. The average use from Well 1 and Well 3 combined was approximately 117,000 gpd during 1988, consistent with 1987 usage. Well 5 supplies drinking water to the new colliding beam facility, which is located at the straight section at D-0, with a current usage of about 1,100 gpd.

Figure 3.7.1 also shows all existing well locations. The inactive wells in the proposed FMI area, 12 and 24B, have been used only for groundwater monitoring of radionuclides.

3.7.2 Quality

Vicinity. The groundwater quality in the Kane County area is generally good but shows a real variability as well as differences among the four aquifers. Radium occurs naturally in the groundwater, and in the eastern portions of the Kane County area, the water is not potable without appropriate treatment due to elevated radium levels.

The Silurian aquifer, which is Fermilab's primary drinking water source, has high concentrations of TDS, hardness, sulfate, chloride, sodium and total iron. The greatest concentrations are generally found in areas of greatest population density and pumping rate; the lowest concentrations are generally found in the area between the Fox River and the West Branch of the DuPage River.

Fermilab. During accelerator operations, radioactivation of the soil occurs in target and beam loss areas on the Fermilab site. Although the glacial drift clay beneath the property forms a barrier to the downward percolation of any water containing radioactivity, it is possible that these radionuclides could leach into the groundwater. Consequently, Fermilab has undertaken a comprehensive program of groundwater monitoring for radioactivity since 1972, the results of which are contained in Fermilab's annual "Site Environmental Report." The samples are analyzed in a manner which would detect levels resulting in a dose of 0.4 mrem/yr to an individual consuming 2 liters per day of drinking water, which is one tenth of U.S. EPA's drinking water standard for the members of the general public. In 1989, as in other years, no measurable accelerator-produced radioactivity was reported in any of the groundwater monitoring wells on the Fermilab site. Fermilab's on-site groundwater monitoring wells are located between the source of potential groundwater contamination and the site boundary. Because these wells have never detected accelerator-produced radionuclides, it is unlikely that groundwater off site is contaminated from Fermilab operations.

A very conservative approach to beamline design for all target stations and beam loss areas has been developed at Fermilab to minimize risk to groundwater due to Fermilab operations. A computer is used to calculate the amount of leachable radionuclides produced

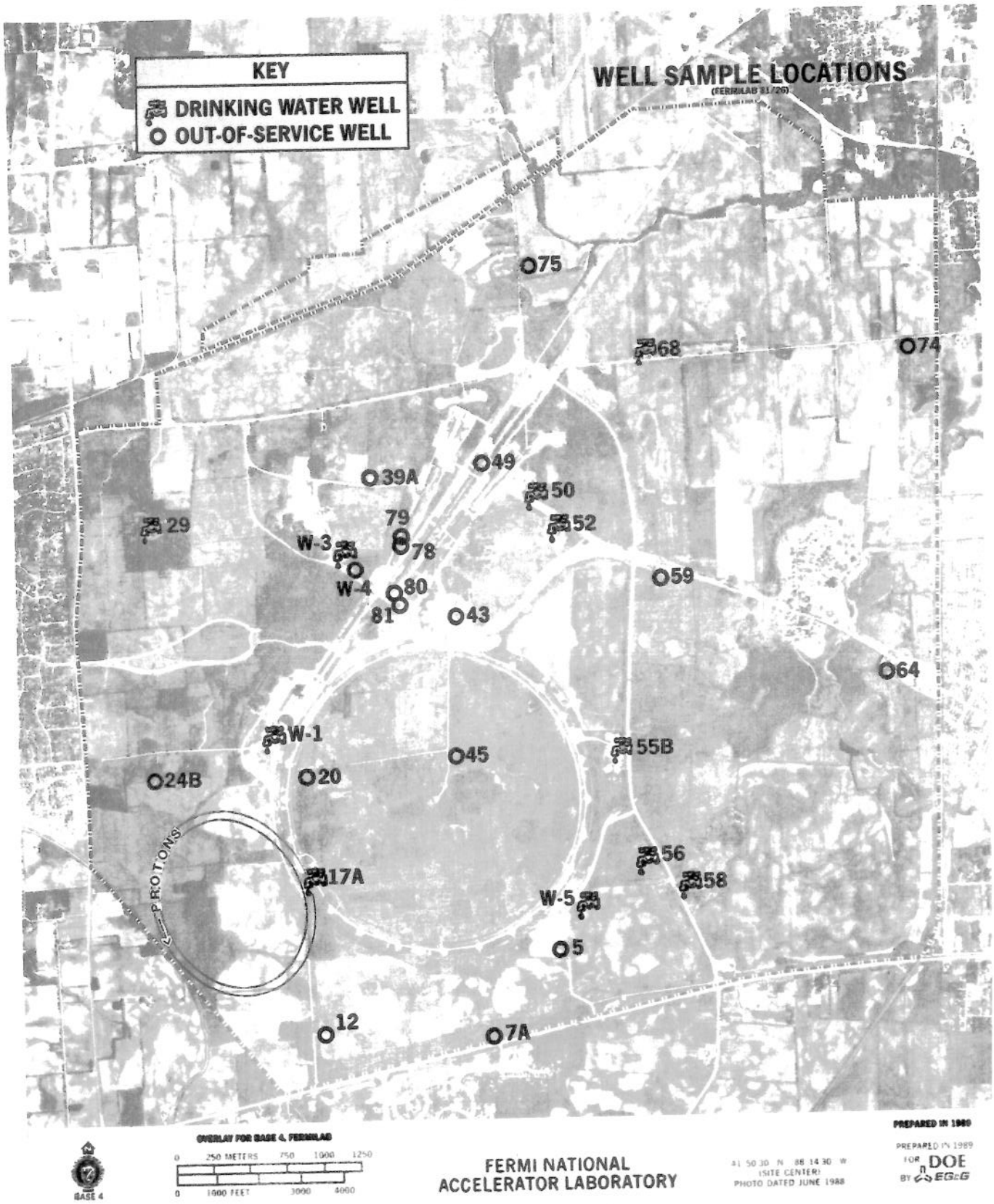

KEY
DRINKING WATER WELL
OUT-OF-SERVICE WELL
WELL SAMPLE LOCATIONS
(FERMILAB 81/26)
75
68
74
49
39A
50
79
52
29
W-3
78
W-4
80
59
81
43
64
W-1
45
55B
24B
20
PROTONS
56
17A
58
W-5
5
12
7A
OVERLAY FOR BASE 4, FERMILAB
0 250 METERS 750 1000 1250
0 1000 FEET 3000 4000
BASE 4
FERMI NATIONAL
ACCELERATOR LABORATORY
41 50 30 N 88 14 30 W
(SITE CENTER)
PHOTO DATED JUNE 1988
PREPARED IN 1980
PREPARED IN 1989
FOR DOE
BY EG&G

FIGURE 3.7.1

during one year of operations in soil regions external to a beamline enclosure housing a given target station. Previous studies have determined that tritium and ^{22}Na are the principal radionuclides of concern to the groundwater because they are the only ones that are both produced in significant abundance and are sufficiently leachable from the soil present at Fermilab. This model assumes that all the radionuclides produced due to the operation of a given target station migrate downward to the water table at unrealistically high velocities (2.13 m/yr for tritium and 0.94 m/yr for ^{22}Na) and propagate to a well used by a single user. The activity is assumed to be diluted in 40 gpd of water. The former assumption underestimates the reduction in the activity due to radioactive decay during the downward migration. The latter assumption greatly overestimates the amount of activity, and its concentration, which could arrive at the faucet of a prospective user. The model is used to design the shielding between the particle beam and the soil external to the enclosure so that the shielding is sufficient to assure that the hypothetical user does not receive a committed effective dose equivalent in excess of 4 mrem/yr from drinking 2 liters per day of the water. The number of protons targeted per year at each target station is also limited to assure that this criterion for groundwater protection is met under operating conditions that have been established for many years at Fermilab.

Fermilab also samples groundwater wells for nonradionuclide pollutants, the results of which are also documented in the annual "Site Environmental Report." Although the wells located near the proposed FMI site have so far not been sampled for nonradionuclides, the sampling results from other wells on the Fermilab site indicate good water quality.

3.8 SURFACE WATER

3.8.1 Hydrology and Floodplains

On most of the Fermilab site, surface water runoff is to the southeast into the West Branch of the DuPage River. In the proposed FMI area, however, surface drainage is to the southwest towards Indian Creek and the Fox River. As illustrated in Figure 2.1.2.2, the construction of the FMI would traverse Indian Creek's floodplain.

The headwaters of Indian Creek, which is a major tributary of the Fox River in Kane County, lies within the Fermilab property boundaries. According to a flood insurance study carried out by Harza Engineering in 1978, the floodplain of Indian Creek is relatively wide near its confluence with the Fox River because the banks of the Creek are poorly defined and the topography is generally flat. In this area, development is primarily industrial, of moderate to heavy density, with some commercial structures. The floodplain of Indian Creek upstream of High Street contains moderate to high density residential development. The floodplain is rural upstream of I-88.

Due to flooding problems in December of 1982 and July of 1983, a flood control reservoir was designed and constructed south of Molitor Road and east of Farnsworth Avenue. This 310 acre-feet flood storage reservoir, whose construction was finished in the fall of 1990, should solve the Indian Creek flooding problem in the area south of Fermilab.

The 100-year flood limit is shown in Figure 4.1.3.1. The hydrology studies conducted by the U.S. Department of Housing and Urban Development, the Federal Insurance Administration, the U.S. Department of Agriculture, Soil Conservation Service, and the Illinois Department of Transportation, Division of Water Resources (IDOT/DWR)

that lead to the sizing of the Molitor Road reservoir assumed that Fermilab would maintain the hydrologic characteristics that exist on the Fermilab site. In order to accomplish this objective in light of the proposed FMI, Fermilab contracted with a consultant to carry out a complete hydrology study of the Indian Creek watershed on the Fermilab site. This work is reported in the Joint Application for a Section 404 Nationwide 26 permit submitted to the COE, the IEPA, and the IDOT/DWR on September 9, 1990. The significant result of the study is that the consultant needed to revise the information and data contained in previous reports to bring this information and data up-to-date to reflect already accomplished changes in the Indian Creek watershed. They found the peak discharge for the 100-year flood case at the double 10'x7' box culvert under the Illinois Prairie Path (this is where Indian Creek leaves the Fermilab site) to be 618 cubic feet per second, and the corresponding water elevation to be 734' above sea-level.

3.8.2 Quality

During accelerator operations, radioactivation of the soil occurs in target and beam loss areas on the Fermilab site. Leaching of these radionuclides provides a possible mechanism for transport of Fermi-produced radionuclides into the surface runoff waters. The principal accelerator-produced radionuclides of concern in such waters are ^{3}H and ^{22}Na. Consequently, a comprehensive program has been in effect since 1972 to monitor surface water quality and sediments. Measurements are made of on-site concentrations of radionuclides in Fermilab surface waters and sediments, in Fermilab's cooling ponds, and in the Fox River and West Branch of the DuPage River which receive runoff from Fermilab. The sampling results are documented in Fermilab's annual "Site Environmental Report."

In 1989, as in other years, there were no measurable concentrations of accelerator-produced radionuclides (^{3}H or ^{22}Na) in any surface water samples taken from any creeks, ponds, lakes or ditches within the Fermilab site. There are no known sources of abnormal concentrations of other radionuclides in surface waters and no abnormal concentrations of these have been identified. Similarly, there were no detectable concentrations of ^{3}H or ^{22}Na in any surface water sediment samples. The surface water sediments do contain concentrations of ^{137}Cs consistent with those expected from atmospheric nuclear weapons testing. The ongoing monitoring program for surface waters has not done extensive sampling for non-accelerator produced radioactivity since there is no known source of non-accelerator produced radioactivity upstream of the Fermilab site.

In addition to radionuclide monitoring, Fermilab samples on a semi-annual basis surface waters both on- and off-site for fecal coliform and sample parameters, including pH, dissolved oxygen, BOD_5, and suspended solids. These results are also documented in Fermilab's annual "Site Environmental Report." Water samples of Indian Creek are taken at Butterfield Road, which is approximately 2800' south (downstream) of the Fermilab site boundary. The 1989 sampling results are reported in Table 3.8.2.

In 1990, Fermilab contracted with a consultant to conduct a stream survey of Indian Creek. As discussed in Section 3.12.4.6 below, 3 areas were sampled within the Fermilab site. Water depth ranged from 6" to 12" in dredged areas to 3' in natural areas. At each site water quality parameters, benthic invertebrates and the algae community were assessed. At one additional site water quality parameters and algae were also sampled.

Dissolved oxygen concentration ranged from 5.7 mg/l to 10.1 mg/l. These concentrations are within the IEPA's water quality standards for general use waters. The

Table 3.8.2 Indian Creek water quality report for calendar year 1989

	pH		DO mg/l		BOD_5 mg/l		Susp. Solids mg/l		Fecal Coliform mg/l	
	April	Oct	April	Oct	April	Oct	April	Oct	April	Oct
Indian Creek	8.2	7.4	11	9.2	2.5	2	14	12	220	Confluent

samples were taken from midday to 3pm, peak photosynthetic hours. The temperature ranged from 21.9°C to 28.1°C. Conductivity and pH were within normal limits. Conductivity ranged from 748 to 883 microhms/cm, and pH was neutral, from 7.0 to 7.5.

3.8.3 Wetlands

Fermilab retained a consultant in March 1990 to conduct a field reconnaissance of the proposed construction site and immediately surrounding areas to determine the presence and extent of wetlands. In order to do so, the consultant employed the methodology contained in the "Federal Manual for Identifying and Delineating Jurisdictional Wetlands," Federal Interagency Committee for Wetland Delineation, 1989 (methodology). This manual requires that 3 technical criteria, hydrophytic vegetation, hydric soils, and wetland hydrology, be met in order for an area to be classified as a wetland.

At the proposed FMI site, a series of soil pits were excavated along transects that were perpendicular to the elevational gradient. At each soil pit, the following data were collected and recorded: dominant floral species; soil colors; and indications of inundated and/or saturated soils. Then, the approximate wetland boundary was plotted on a 1987 1"-400' aerial photograph from the Sidwell Corporation.

Based upon this investigation, the consultant identified 9 wetlands, W-1 through W-9, (totaling approximately 100 acres in size) near the proposed FMI project area. (See Table 4.1.3.2.1.) Six of these wetlands (totaling approximately 88 acres in size) are within the proposed FMI boundary; a portion of 5 of these wetlands (W-1, W-2, W-4, W-5, W-6) would be disturbed by the proposed FMI construction. The results of the consultant's investigation are reported in the Joint Application for a Section 404 Nationwide 26 Permit.

As illustrated in Figure 4.1.3.1, most of the wetland acreage within the project area is adjacent to Indian Creek. This contiguous nature allows for extensive wetlands with several different classifications. W-4 is the largest wetland area within the proposed project boundary, comprising 65.27 acres, in the floodplain woods. A portion of the heron rookery lies within W-4, which is classified as a palustrine forested wetland. However, the portion of the wetland that contains the heron rookery would not be affected by FMI construction or operation. Cottonwoods, Populus deltoides, and box elder, Acer negundo, are the dominant vegetation in the area. Areas of palustrine emergent wetland also occur in this wetland. W-1, the next largest wetland in the area and also a palustrine forested wetland, is 11.67 acres in size. It is temporarily flooded and consists of box elder, cottonwoods, and silver maples, Acer saccharinum, and several old pin oaks, Quercus palustris. This area was farmed approximately 20 years ago.

W-3 is also a palustrine forested wetland that is seasonally flooded. It is 6.49 acres in size and contains vegetation similar to W-1 along with some black cherry, Prunus serotina, that borders its edge. W-7 is a palustrine emergent and scrub-scrub wetland that seasonally floods and supports river bulrush, Scirpus fluvatilis, and smartweed,

Polygonium spp. It is 5.52 acres in size. W-2 is a narrow wetland of 5.45 acres along Indian Creek. It is a lower perennial riverine system that is intermittently exposed and contains cottonwoods, silver maples, river bulrush, reed canary grass, Phalaris arundivaoa, and red osier dogwood, Cornus stolonifora.

W-6 is a seasonally flooded forested wetland of 4.48 acres and consisting of box elder, cottonwood, and red osier dogwood. W-5 is a palustrine emergent wetland that consists primarily of cattail, Typha latifolia. Reed canary grass, red osier dogwood, and young cottonwood and box elder trees also exist in this 0.80 acre wetland. Finally, W-8 and W-9 are both palustrine emergent wetlands of 0.39 and 0.34 acres, respectively. As a result of recent farming, W-8 is devoid of vegetation; W-8 is temporarily flooded at least 7 days per year. W-9 is seasonally flooded and contains sedge species, Carex spp., prairie cord grass, Spartina pectinata, and cottonwoods.

Fermilab's wetland consultant concluded that the relatively large area of wetlands near the proposed project area elevates the quality of that wetland system. The consultant also performed a WET II analysis (Adamus 1987) on the wetlands that would be disturbed by construction. Although this procedure does not provide an overall wetland function value, it does estimate, for comparison purposes, the functional values of the wetlands that would be disturbed. The results of this analysis reveal that W-4 is a higher quality wetland than the other 4 that would be disturbed because of its aquatic diversity, uniqueness/heritage, and sediment/toxicant retention capacity. As discussed in Chapter 4, the amount of W-4 that would be disturbed by construction has been reduced considerably from the project's original design.

The wetland consultant also examined the proposed location of AB-5 and the Kautz Road Master Substation (KMS) for the presence of wetlands. No wetlands were found in these areas.

3.9 OCCUPATIONAL HEALTH AND SAFETY

Fermilab has implemented a program for keeping radiation exposures to its employees as low as reasonably achievable (ALARA). A cornerstone of this program is a self-imposed guideline that has been implemented for over 10 years of limiting exposures to workers to less than 2,500 mrem/yr. During operations of the existing Fermilab accelerators since this limit has been in place, this limit has never been exceeded. In fact, it is rare for an annual dose to an individual to exceed 500 mrem/yr. The annual collective dose equivalent to Fermilab employees is presently about 25 person-rem/yr.

3.10 WASTE GENERATION

Fermilab presently generates approximately 5-6 truckloads of regulated chemical wastes per year. (See Section 2.1.3.2.) Over the last 5 years, these wastes have been comprised of an annual average of about 6100 gallons of waste regulated under the Resource, Conservation and Recovery Act (RCRA); 13,300 gallons of polychlorinated biphenyls (PCBs) waste regulated under the Toxic Substances Control Act (TSCA); and 2,500 gallons of Illinois special waste. (The TSCA wastes are expected to decrease and represent a continuous phase-out of electrical equipment at Fermilab containing PCBs.) Except for the PCBs, these wastes are mostly wastes typical of light industrial operations and are disposed of in accord with state and federal regulations and DOE requirements. A continuing state permitted RCRA program exists to minimize the generation of these wastes. Operation of existing accelerators at Fermilab result in the generation of

approximately 120 cubic yards per year of low level radioactive material. This is due chiefly to interactions of the accelerated proton beams with accelerator components. Approximately 80% of this volume is encased in concrete shielding blocks that are reused in experiments. Fermilab disposes of the remainder (approximately 22 cubic yards per year after compaction of appropriate items) at DOE disposal facilities, the current facility being in the State of Washington.

3.11 WASTEWATER DISCHARGE

As discussed in Section 2.1.2.2, ICW is used in many of Fermilab's experimental areas for conventional magnet cooling. The ICW is passed through heat exchangers where it is heated from LCW. The ICW is then pumped to cooling ponds where most of the heat is dissipated by evaporation. Normal water flow carries some water of elevated temperature into creeks leaving the Fermilab site. DOE is currently preparing an NDPES permit application for the discharge of this water.

3.12 ECOLOGY

3.12.1 Ecological Resources

Fermilab contains many of the lowland ecosystems typical of the continental United States. The diversity of the biological communities is high. Although the Fermilab site has largely been disturbed by development of residential, agricultural, and industrial facilities, biota are plentiful and areas of natural systems (prairie, wetlands, and woodlots) are found on the site. Reconstructed prairie areas are maintained on the Fermilab property. Fermilab also has a substantial amount of wetlands, approximately 900 acres.

The DOE designated Fermilab as a National Environmental Research Park (NERP) in 1989. These parks serve as outdoor laboratories where scientists and others conduct research on important environmental issues. Fermilab is one of 7 such parks and it provides research opportunities in tall grass prairie and the prairie's interfaces with marshes, scrubby wetlands, creeks, ponds, and deciduous forests. Various environmental research proposals have been evaluated and programs are now underway utilizing the unique ecological features of the Fermilab site.

3.12.2 Ecosystems

The terrestrial ecosystems on the Fermilab site include: upland forests; palustrine, lacustrine, and riverine wetlands; savannah; mesic prairie, and prairie reconstruction; and leased agricultural systems including row croplands. Aquatic ecotypes in the area include small ponds and lakes, reservoirs, and thousands of feet of first and second order streams.

3.12.3 Sensitive Terrestrial/Aquatic Communities

Fermilab has sensitive communities, relic populations, and unusual remnant associations. For example, remnant woodland communities are present, as are a few acres of savannah. The prairie reconstruction project on the Fermilab site also represents a unique opportunity to redevelop an area of mesic prairie.

During the SSC site search, it was determined that Fermilab had many small remnant ecotypes with host communities and populations that are sensitive or ecologically important.

3.12.3.1 Migratory birds. As discussed in the introduction and illustrated in Figure 1.1.3 a great blue heron rookery exists inside of the proposed FMI ring in an area that would not be disturbed by construction or operation. The great blue herons are subject to regulation under the federal Migratory Bird Treaty Act, 16 U.S.C. Section 703 et seq. This act prohibits, among other things, the hunting, capturing, killing, or possessing of regulated species.

Great blue herons are decreasing in numbers due to the reduction in suitable habitat, but are far from qualifying for endangered, threatened, or under consideration for protection in the U.S. or Illinois. However, in northern Illinois only a few heron rookeries exist. The heron rookery was discovered in 1985 and grew to approximately 40 nests by 1989. In 1990 it decreased in size to 13 nests, a normal variation and a demonstration of the variability that occurs in great blue heron rookeries. No herons nested in the area during 1991. During 1991, several nests were identified inside the Tevatron complex. The lifetime of an average heron rookery is 15 years.

3.12.4 Threatened, Endangered, and State-Protected Species

Within the proposed construction area, there are no plants or animals of economic importance or which are federally listed as threatened/endangered that are at the extent of their range. DOE has completed coordination with the U. S. Fish and Wildlife Service pursuant to the Fish and Wildlife Coordination Act and the Endangered Species Act. In response to DOE's inquiry, the Service concluded that the measures proposed by DOE would "avoid any impacts to the heron rookery and negate any loss of wetlands."

In March 1991, DOE initiated consultation with the Illinois Department of Conservation (IDOC) pursuant to the Fish and Wildlife Coordination Act. In June 1991, IDOC responded that construction of the proposed FMI would not adversely affect Illinois threatened/endangered species or identified natural areas. IDOC raised several questions and observations concerning the effect of the proposed project on the heron rookery that was located in what would be the inside of the FMI from sometime before 1985 until 1990. IDOC requested the name of the ornithologist that is employed to make recommendations concerning the herons, more information on the buffer zone were the herons to return to the nesting area, the relocation of trees, and the control of water levels in the area. By letter dated August 1, 1991, DOE responded to these questions and observations.

In the proposed Illinois SSC site study, the U.S. Fish and Wildlife Service listed 10 federally protected species as potentially residing in the vicinity of the proposed Illinois Site, a very small portion of which would be occupied by the FMI. Similarly, Illinois listed 87 state-protected species in this same area. Accordingly, it was judged prudent to further investigate whether there are any threatened or endangered species that might be affected by the proposed construction. Fermilab therefore contracted with consultants in birds, plants, insects, amphibians, fish and mammals to conduct field surveys in the area that would be impacted by the construction.

Suitable habitat and the presence or absence of the listed species were recorded. The consultants' reports are cited in the reference section. Summaries of the reports follow.

3.12.4.1 Vegetative survey. This survey was conducted by the scientist responsible for the 387 acres of reconstructed prairie inside of the Tevatron; an activity which has been underway since the original planting was initiated in 1975.

The vegetative survey of the land proposed for building the FMI was undertaken on July 24, 27, and 31, 1990. This involved walking the projected path where the FMI is to be constructed, classifying plant communities and recording the plant species observed. Particular attention was given to the state and federal endangered and threatened species that were identified during the site studies for the SSC in Illinois.

The vegetation that would be affected by FMI construction into 6 different plant communities. These communities are not virgin. Because of their successional or degraded nature, the survey concluded that it is unlikely these communities would harbor rare and endangered species. From surveys and studies conducted during the past 15 or more years, no federally designated endangered or threatened plant species has ever been found on the Fermilab site.

3.12.4.2 Nursery roosts of Indiana bat (Myotis sodalis). The Indiana bat was listed in the EIS for the proposed SSC Illinois site as a federally designated endangered species.

A survey of the FMI site was conducted on May 31, 1990 and July 5, 1990. Trees were evaluated and marked and bat detectors were used. No Indiana bats were detected and the consultant concluded that it is very unlikely that nursery roosts of the Indiana bat exist within the proposed FMI site.

3.12.4.3 Insects. A federal Category 2 listed rare dragonfly Somatochlora hineana, although not listed in the EIS for the proposed SSC Illinois site, was determined to be a possible inhabitant of the proposed FMI construction area.

Fermilab contracted with an expert who had studied insects in the Fermilab reconstructed prairie plot as well as in other Illinois sites, to survey the FMI proposed construction area. He visited the site between June 15 and July 23, 1990.

He found the insect fauna in this area to be comprised mostly of wide-ranging species with broad ecological tolerances. He did not encounter Somatochlora hineana. He further concluded that the floodplain/wetland that borders Indian Creek does not seem to support any of the endangered or threatened insect species currently listed by the Illinois Endangered Species Board.

3.12.4.4 Amphibians and reptiles. Ecological environmental concerns associated with the proposed FMI construction in the category of amphibians and reptiles center on the two state endangered reptile species (the spotted turtle, Clemmys guttata, and the eastern ribbon snake, Thamnophis sauritus). During a survey by a consultant of the proposed FMI area on May 23, and June 3, 15, and 30, neither were found.

3.12.4.5 Birds. Over several years, breeding surveys were conducted of the birds of Fermilab. The results are published as a Bulletin of The Chicago Academy of Sciences, Vol. 14, No. 4 (1989). The findings fall into the following categories:

1. Because of the lack of suitable habitat it is unlikely that the surveyed species will use Fermilab property for anything more than a temporary resting and foraging area. (Example: Double-Crested Cormorant.)

2. The surveyed species use Fermilab as a temporary stop-over point during migration only. (Example: American Bittern.)

3.12.4.6 Fish and aquatic biota. Even though there were no fish listed as endangered or threatened on the federal or state lists reported in the EIS for the proposed SSC site in Illinois, it was judged to be of value to conduct a fishery survey of Indian Creek.

In 1990, the entire length of Indian Creek as it traverses the Fermilab property and discharges into the Fox River was surveyed. It was concluded that the low-head dams on Indian Creek apparently form partial barriers to upstream migration. For example, no goldfish or carp were found despite the discharge of Indian Creek into the Fox River. It was reported that no state or federal endangered or threatened fish species were found. Habitat suitable to the Blacknose Shiner, Notropis heterolepis, was not observed despite reconnaissance of the full length of Indian Creek. Physical examination of the stream habitat and evaluation of the collected fish species indicate a relatively degraded condition and a poor to fair fishery. Habitat and fisheries improved through the Fermilab property, but recruitment and physical conditions are influenced by the cooling ponds that are associated with the Main Ring.

In 1990, Fermilab also conducted a stream survey of Indian Creek within the boundaries of Fermilab. The survey concluded that dredged areas of Indian Creek are relatively depauperate in flora and fauna because of the lack of suitable habitat and physical disturbance. These areas are also limited in primary productivity due to the intensive shading by the surrounding forest. Areas that have not been dredged and are not limited by shading support aquatic macrophytes, benthic invertebrates and high algal productivity.

Areas upstream of the proposed FMI project experience severe algal blooms largely as a result of natural processes. The two areas downstream of Fermilab's existing cooling pond are choked with filamentous algae. These areas may experience severe oxygen depletions at night, when plant respiration is occurring, or later in the season when the bloom starts to scence and decompose.

No federal- or state-protected fish, plants, or invertebrates were identified during the survey.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

4.1 CONSTRUCTION OF PROPOSED FMI

4.1.1 Land Use

Most of the 135-acres that would be affected by construction of the proposed action would be converted from grasslands, fields, woodlands and wetlands to a grass covered earth shielding berm, a service roadway, and cooling ponds. Five and seven-tenths acres of wetland would be filled and 8.55 acres of new wetland would be created. Floodplain mitigation would create 29 acre-feet of flood storage. Seven small service buildings, a building that would be located above the tunnel that would convey protons from the Booster to the FMI, AB-5, and a reconstructed building at F0 are proposed. The proposed construction area is within Fermilab's existing site and has been intended eventually to support energy research facilities. (See "Fermilab Site Development Plan," January 1990.) Development of the entire FMI site would decrease the amount of undeveloped areas at Fermilab by approximately 4%.

Excavation and earth moving during construction are discussed in Section 2.1.4. Approximately 870,000 c.y. of material would be excavated during FMI construction. Current design of the proposed FMI calls for about 705,000 c.y. excavated material to be used to create the up to 14-foot high above existing grade shielding berm. The approximately 165,000 c.y. of excess excavated material would be moved to the earth stockpile area that was created during Tevatron I construction (see Figure 4.1.3.1). This stockpile was depleted in the Summer of 1991 when shielding improvements were incorporated into the Tevatron. Erosion controls which are described in Section 2.1.4 would insure no contamination of waters. Any future need for earth shielding would be accommodated from this stockpile.

As discussed in Section 3.6, all of the proposed FMI site lies in Kane County. Kane County designates the area as Institutional Private Open Space. The KMS and a part of the 345 kV power line would be on the Fermilab site in DuPage County, in an area zoned R-2 exempt. AB-5 would also be located in DuPage County in a developed area within Fermilab's existing Industrial Area. FMI construction would not be inconsistent with any regional land use plans for surrounding areas.

Pursuant to the requirements of the federal Farmland Protection Policy Act, DOE requested the U.S.Department of Agriculture, Soil Conservation Service, to conduct a Farmland Conversion Impact Rating to determine whether any farmland on site that was once leased by DOE for farming that would be affected by FMI construction is subject to the Act's requirements. On September 18, 1991, Soil Conservation Service, responded that no Farmland Conversion Impact Rating submission is necessary for the proposed FMI construction.

4.1.2 Work Force

Because of the relatively small size of the construction work force needed (see Section 2.1.5), and the fact that the Fermilab region is already highly urbanized (see Section 3.3), any effects from the increased work force for construction of the proposed

FMI would be small. The impact of the 130 construction workers required is estimated to be less than 0.01% of the baseline regional job opportunities. The proposed construction work force, even when combined with Fermilab's existing 2,335 employees is insignificant when compared to the 8 million people within a 50 mile radius of Fermilab. Following construction, the workers would return to the metropolitan Chicago work force where they should be easily absorbed. Services and housing are not limited in the area.

4.1.3 Surface Water

4.1.3.1 Hydrology and floodplains. The proposed FMI would alter a portion of Indian Creek's 100-year floodplain. Calculations indicate that 29 acre-feet of flood storage is needed to compensate for the construction of the FMI within the floodplain. As shown in Figure 4.1.3.1, this flood storage area would be provided on 12 acres within the FMI, which would be constructed during the initial phase of FMI construction. Most of the flows associated with a storm larger than a 10-year event would be diverted around the FMI into and through the northern and southern cooling ponds using a passive overflow system. The remainder of the flood flow would be routed to the FMI infield to maintain normal flows and retention conditions. Thus, the cooling ponds would provide a temporary retention of the large flows. IDOT/DWR Dam Safety Section has determined that the earthen berm associated with the FMI and its appurtenance should be designated a dam and principal spillway.

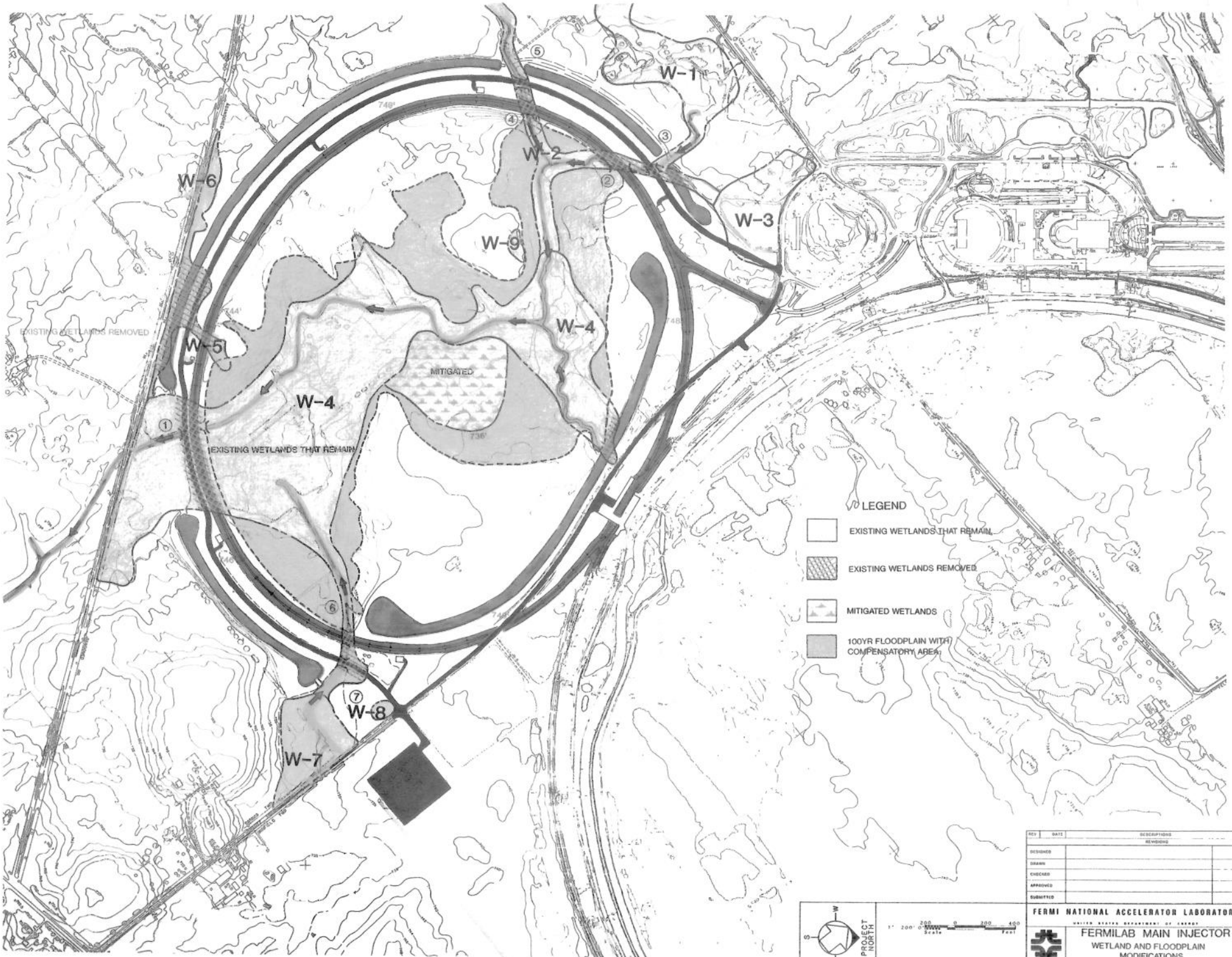
Preliminary engineering studies have been completed to prevent any detrimental effects to upstream and downstream areas. No reduction in the retention capacity of the Indian Creek drainage basin would occur. The TR-20 hydrologic model was employed in designing the project. The size of the proposed Culvert #1, which is shown in Figure 4.1.3.1, would be restricted and the modeling results show a peak discharge at the Prairie Path culvert (which is to the south of Culvert #1) for a 100-year storm of 618 cubic feet per second, with a corresponding peak flood water elevation of 734' above sea level. These conditions would be maintained to avoid any increased flows downstream. The impounded water would compensate for the storage loss due to the upstream diversion of flow at Culvert #3, also shown in Figure 4.1.3.1.

No property damage would result from floods less than or equal to the 100-year event. Service buildings associated with the FMI would be constructed above the flood level so that these structures would not be damaged although access may be temporarily limited. Pumps in the tunnel would pump water from the underdrain system into the FMI cooling ponds. FMI construction would not adversely affect the recently constructed reservoir near Molitor Road. IDOT/DWR has reviewed and preliminarily approved the hydrologic design and configuration of the earthen berm and culvert. It has also reviewed and preliminarily approved the proposed floodplain modification.

4.1.3.2 Wetlands.

4.1.3.2.1 Disturbances. Most of the wetland acreage within the project area is adjacent to Indian Creek. As shown in Figure 4.1.3.1, and discussed in Section 3.8.3, this contiguous location includes extensive wetlands with several different wetland classifications. FMI construction would traverse several wetlands.

As revealed in Table 4.1.3.2.1, W-4 is the largest wetland area within the project boundary. This wetland would receive 2.85 acres and 0.30 acre of permanent and temporary fill, respectively. However, because of the amount of fill in relation to the size of


W-1
W-2
W-3
W-4
W-5
W-6
W-7
W-8
W-9
W-4
EXISTING WETLANDS REMOVED
MITIGATED
EXISTING WETLANDS THAT REMAIN
748'
744'
736'
LEGEND
EXISTING WETLANDS THAT REMAIN
EXISTING WETLANDS REMOVED
MITIGATED WETLANDS
100YR FLOODPLAIN WITH COMPENSATORY AREA
PROJECT NORTH
Scale
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DESIGNED
DRAWN
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APPROVED
SUBMITTED
FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY
FERMILAB MAIN INJECTOR
WETLAND AND FLOODPLAIN MODIFICATIONS
DRAWING NO
FIG. 4.1.3.1
REV

Table 4.1.3.2.1 Wetland impacts

Wetland	Approximate Acreage	Approximate Impacted Acreage	Total Permanent Fill	Temporary Cooling	Ponds
W-1	11.67	0.09	0.09	-	-
W-2	5.45	1.51	1.41	-	0.10
W-3	6.49	-	-	-	-
W-4	65.27	3.29	2.85	0.30	0.14
W-5	0.80	0.35	0.35	-	-
W-6	4.48	1.90	1.0	-	0.90
W-7	5.52	-	-	-	-
W-8	0.39	-	-	-	-
W-9	0.34	-	-	-	-
TOTAL	100.41	7.14	5.70	0.30	1.14

wetland, the effects of the project on the functional values of this wetland would be minimal. The overall function and floristic character of W-4 should not diminish.

Construction of the berm and road would alter W-2. The berm complex and road would intersect W-2 in three areas. This wetland would receive 1.41 acres of permanent fill, and culverts would be installed in these areas to retain the hydrologic characteristics of the area.

Fill is also proposed within W-1, W-5 and W-6. The effects of fill on W-1 would be minimal since only approximately 0.09 acre would be disturbed. The majority of the wetland would be outside of the berm complex so that wetland functions would be preserved. Almost half of W-5 and W-6 would be altered by the proposed construction. However, due to their relatively smaller sizes, these wetlands provide less functional value than the main wetland complex, W-4. After construction, 0.9 acre of W-6 would be converted into a portion of a cooling pond.

The proposed modifications to these wetlands should not adversely affect the hydrologic characteristics of the overall area since the project would affect less than 6% of the wetlands in the area. For the same reason, the overall quality of the existing wetland would not be significantly affected.

4.1.3.2.2 Mitigation. The proposed plan includes the avoidance of alterations, minimization of alterations, rectification of alterations (consisting of the repair or restoration of affected areas), the reduction of impacts, and the compensation for the disturbances through replacement. By selection of the proposed project configuration, with respect to location, that alters the least amount of wetland acres (7.14 acres), wetland disturbances would be avoided to the fullest practical extent. Construction of the FMI inside the Tevatron, the only other technologically possible FMI location, would disturb approximately 27 acres of the existing wetland within the interior of the Tevatron enclosure.

Wetland alterations have been minimized by conducting a thorough design study that analyzed both engineering and environmental considerations. Several modifications of the original plan have been developed to harmonize the engineering design with the existing environment. The original design plan placed the Main Injector Road away from the berm

around the entire perimeter of the complex outside of the berm. The original design also contemplated construction of cooling ponds in W-4. This design was modified enabling a substantial reduction in the area of W-4 that would be disturbed.

The disturbance of the vegetation in W-4 has been minimized by the realignment of the Main Injector Road and the exclusion of the cooling pond from the area. The maximum amount of vegetation, which will serve as a buffer zone between human activity and the heron rookery, possible within current construction limits would be maintained. In the proposed construction plan, the 3 separate bands of wetland disturbance, the Main Injector Road, cooling ponds and the berm, are condensed into 1 section of alteration.

Disturbances to the wetland areas would be further minimized by the drainage structures designed to pass water through and under the shielding berms, road beds, and ponds. These structures would maintain the normal surface water flow through the interior of the FMI. As discussed in Section 4.1.3.1, during normal operation, the 10-year flow of Indian Creek and its tributaries would continue unimpeded as it passes through the FMI area. Most of the excess storm flows that occur at lower frequencies would be diverted through a series of ditches and cooling ponds that join Indian Creek to the south. This design would also avoid any permanent disturbances to the wetland hydrology of the area.

DOE also considered the impact of the Main Injector Road upon the wetlands. First, DOE took into account the increased impervious area due to the road in the hydrologic model employed to design the proposed FMI project. In addition, the Main Injector Road would have only sand applied during bad weather in order to not increase the salt content of the wetlands.

Pursuant to the Special Conditions in the COE permit, the COE has approved of a detailed mitigation plan, a re-vegetation plan, a five-year management and monitoring plan, and a detailed grading plan. When construction is conducted in sensitive wetland areas, the wetland disturbance would be minimized by maintaining construction equipment on floating mats, thereby reducing the amount of soil compaction. Temporary wetland disturbances due to increased erosion, sedimentation, and turbidity from construction activities would be minimized by implementing a soil erosion control plan as discussed in Section 2.1.4. To further lessen the vegetation disturbances, clearing for construction purposes would be restricted to only essential clearings.

Wetland areas disturbed by construction activities but not directly filled would be revegetated as soon as practicable and new vegetation would be monitored. Areas of temporary fill, for construction purposes, would be excavated to the original grade and restored to preconstruction condition. DOE would maintain the existing watershed characteristics within the project site and the surrounding areas. These actions should rectify any temporary wetland disturbances.

The total amount of wetland acres filled would be mitigated at a ratio of 1.5 to 1. (See Figure 4.1.3.1.) At the request of the COE the mitigated area will consist of approximately 2.30 acres of interspersed sedge communities and the remainder of the area, approximately 6.30 acres, will have some plantings of trees similar to those in the surrounding wetland. The created wetland habitat would be located adjacent to Indian Creek; therefore, the new wetland would be constructed in the same watershed as the disturbed wetlands. The goal is to offset significant loss of function that the overall wetland complex in the construction area may experience from the filling of 5.70 acres.

The mitigation concept incorporates the existing soil and hydrology characteristics in the selection of the proposed mitigation site. The proposed site, which was approved as a mitigation area by the COE, was once farmed, supports hydric soil and borders W-4. This area has water and an available seed source. The area would be graded to match the grade of the adjacent wetland to ensure sufficient hydrology is obtained for wetland establishment and success.

The soil removed from filled wetlands would be utilized in the mitigation areas. This soil would provide a soil seedbank for the created wetland area. To the extent possible, existing trees would be relocated from the clearing through the wooded wetlands to the mitigation area. In addition, the planting of 6'-8' tall saplings, consisting of silver maple, Acer saccharinum, and other species such as box elder, Acer negundo, and green ash, Fraxinus americana, characteristic of adjacent wetlands, would be implemented to enhance re-vegetation of the mitigation area. The plants of the sedge meadow areas will include swamp sedge, Carex muskingumensis, which is currently found at the Fermilab site. Other commercially available sedges that are native to Kane County and inhabit sedge meadows to floodplain forests that may be planted include the following species: Carex stipata, Carex convoluta, Carex cristartella, Carex rosea, and Carex grayii. Some blue flag iris, Iris virginica shrevei and river bulrush, Scirpus fluviatilis also may be planted near the stream. A detailed mitigation plan, including a detailed grading plan, a floristic cross section of the area and a discussion of possible cover crops, will be submitted to the COE, concurrent with the final construction documents.

The management of the wetland mitigation site will include the replanting of unsuccessful areas, removal of all litter and debris from the site. A snowfence will be placed around the mitigation area immediately after the planting/seeding of the area to deter human and animal disturbance during the most sensitive period of establishment. Additionally, proper erosion control practices will be followed throughout the entire construction phase of the project.

The subject wetland will primarily be managed for species diversity and wildlife value. Volunteer cattail (Typha spp.) will be removed manually from the wetland. Purple loosestrife (Lythrum salicaria) and other aggressive nuisance species will be controlled by application of manual removal. The use of herbicides will be avoided to the greatest extent possible but may be used if other control methods are unsuccessful. To further discourage Typha spp. growth and other undesirable species the placement of fertilizer in or near the wetlands will be avoided to the greatest extent possible. For the trees planted fertilizer spikes will be used. Additionally, only plant plugs will be placed and natural revegetation will occur to avoid any contamination from seed mixtures that can contain unwanted nuisance species.

The wetland mitigation site will be monitored for a period of five years as prescribed in the special permit condition number 4 of the Section 404 permit. The monitoring program will entail specific floristic and avi-fauna studies as detailed in the Wetland Monitoring Plan. Management objectives will be determined from the conclusions of wetland monitoring results. Monitoring activities are scheduled to occur the first, third and fifth years following the seeding and planting of the area. The preliminary performance criteria for the mitigation site will be 60% surface cover by the second year and 75% cover after three years.

A summary of management activities will be included in the annual Wetland Monitoring Report that will be submitted to the COE.

Over time the mitigation should compensate for any significant loss of function the wetland complex in the area may experience due to fill. The overall disturbance to the wetland complex should be minor, except for the possible deterrent to terrestrial wildlife movement; and the temporary loss of function of the mature forest communities. Upon decommission of the FMI, the diversion structures and created wetlands would remain intact. The mitigated wetland area would not be affected because of the passive nature of the flood control structures that are proposed.

4.1.3.3 Quality. Minor, short-term, localized affects to Indian Creek water quality would result from FMI construction. Turbidity and sedimentation of Indian Creek would be controlled through soil conservation measures during construction as described in Section 2.1.4. DOE and its contractors would ensure that all soil disturbance procedures comply with IEPA guidelines referenced in Section 2.1.4 and the COE and IEPA permit conditions concerning soil erosion control.

4.1.4 Groundwater

As discussed in Section 3.7, groundwater recharge in the proposed construction area follows an extensive pathway through clay-rich glacial till which has considerable capacity to adsorb soluble materials. Construction of the proposed FMI would have no effect on groundwater as the pathway through till would not be short-circuited because excavations would not extend to bedrock. Clay removed from the excavation would be used for the base of the shielding berm and topsoil would cover the upper portion of the berm.

4.1.5 Air Quality and Noise

During construction, minor, short-term localized air quality and noise impacts would result from vehicular traffic and earth-moving operations. To the maximum practical extent, dust would be controlled by established engineering practices, chiefly by water sprinkling of all disturbed earth surfaces and earth stockpiles. Exhaust fumes, such as hydrocarbons, from construction traffic and internal combustion equipment used at the construction site should be rapidly dispersed.

Noise impacts from construction equipment would be temporary and local in nature. As discussed in Section 2.1.4, construction noise from vehicular traffic would likely center on only two separate areas of the site. As discussed in Section 4.1.7.1, precautions would be taken to ensure that construction noise would not adversely affect the heron rookery.

4.1.6 Archaeological and Historic Resources

As discussed in Section 3.4.1, archaeologists surveyed the proposed construction area to determine whether identified sites are NRHP-eligible. Three archaeological areas, Tadpole, Pioneer, and Lorenz, near the proposed construction area would not be affected. However, these areas would be protected from peripheral activities by staking off their boundaries with snowfences in order to preclude construction traffic. In July 1991, the ISHPO concurred with this recommendation.

As discussed in Section 3.4.2, 4 collector finds would be traversed by the proposed FMI and the KMS. The ISHPO has determined that all 4 collector finds are NRHP-ineligible.

Because Fermilab has performed a Phase I archaeological survey of the Fermilab site, including the project area to determine whether any archaeological or historic resources are present, it is unlikely that any unidentified sites exist in the area. However, if a potentially significant discovery is made during construction, reasonable efforts will be made to avoid or minimize harm until the appropriate consultation has taken place.

4.1.7 Ecology

Because of the relatively small amount of the Fermilab site that would be affected by the proposed construction (approximately 4% of undeveloped areas), such construction would have no significant effect on Fermilab's biological communities or on Fermilab's status as a NERP. Moreover, FMI construction would not affect the reconstructed prairie inside the Main Ring.

4.1.7.1 Migratory birds. As discussed in Section 3.12.3.7, from sometime before 1985 to 1990, a great blue heron rookery existed inside the proposed FMI. This rookery would not be disturbed directly by FMI construction. In 1991, the herons nested near the center of the Main Ring instead of inside the proposed FMI. If the herons return to the area inside the Main Ring, there would be no restrictions on FMI construction inasmuch as the herons would be at least 1.0 km from the FMI construction site and construction would not take place in any sensitive areas near the Main Ring rookery.

Fermilab employed an ornithologist to prepare recommendations and precautions for the protection of the rookery inside the proposed FMI. Each year, the ornithologist will observe the proposed FMI area and Main Ring area to determine which site the herons are using. Were the herons to return to the rookery inside the proposed FMI area, the ornithologist's recommendations and precautions, which DOE will follow as part of the proposed action, are as follows:

1. DOE will limit proximity of construction activities to the heron rookery during the heron nesting season. The nesting season is known to vary from year to year, for instance in 1990 the last nestling was gone by July 12. Construction contracts will include flexible start and stop dates, which will be coordinated with an ornithologist.

2. The heron rookery will be protected from excessive construction related noise impacts. It should be possible to construct the FMI while adhering to the recommended low noise requirements. Land within approximately 150 meters of the heron rookery was farmed with the heron in residence, and during June 1990 core drilling took place within 500 meters of the nesting heron without disturbance. In 1991, data on noise tolerance levels was collected using a 1/3 octave-band sound-power meter to establish background levels. This data will be used to further define acceptable construction activity noise level.

   After the proposed FMI construction is complete and noise data from its operation is available, a plan will be developed to protect the heron rookery from being disturbed by FMI operation.

3. The clearing through the wooded wetlands at the downstream end of Indian Creek should be no more than 125' wide. DOE will accomplish clearing to the extent practicable by relocating trees into the area between the proposed FMI and the Prairie Path to improve the shielding between the path and the heron rookery. In

addition, DOE will plant trees in the mitigated wetland adjacent to Indian Creek in order to provide additional protection to the heron rookery.

4. Fermilab will employ an ornithologist to monitor the heron rookery on a regular basis for 5 years to 1) ensure that the FMI operations are consistent with the continued well-being of the heron rookery, 2) determine number of herons breeding and relative reproductive success, and 3) assess future management options, such as construction of artificial nesting sites.

Upon construction of the proposed FMI in accordance with these recommendations, water flow, which varies seasonally, in the general area around the heron rookery would be much more controlled after FMI construction than it is now. This will ensure the best possible conditions for the quality of the site as heron habitat. Construction will also coincide with low flows to insure minimal impact on benthic fauna and fish.

Protection of the heron would also provide protection of habitat for numerous other organisms, including insects, amphibians and reptiles, other bird species and mammals, thereby improving biodiversity of the habitat. For example, an ornithologist concluded that bird species, such as the Black-crown Night Heron, would be protected by the recommended precautions made to ensure protection of the heron rookery.

Construction of the FMI and associated structures would help to improve the bio-diversity of the area in two principal ways. First, the great blue heron rookery site inside the proposed FMI ring exists on property that appears to have been flooded some time in the comparatively recent past. Because of the water-logged soils, many trees have already died, and many more may do so in the future. Even though the construction plans for the FMI include passive water level control, it would also be possible to control water levels thereby increasing the longevity of the trees in the site. Thus, the plant species negatively affected by the flooding and water-logged soils would have the opportunity to increase in population size or to recolonize the area (either through the seedbank or from dispersal from nearby sites). And concomitantly, the various animals, including both invertebrates and vertebrates, that use these plant species should benefit as well.

Second, while the Fermilab property is kept under close inspection by security personnel, nonetheless, from time to time, problems with poachers and other (more benign) intruders have been experienced. The impact of such intrusions on the bio-diversity of the area is impossible to quantify precisely, but it can be assumed that such intrusions have a negative rather than a positive effect. Construction of the injector ring will increase the security of this site, reducing all intrusions into the area to virtually none. This greater security will have positive effects on the bio-diversity of the site.

Human access to the center of the proposed FMI will be limited because of the physical barrier afforded by the FMI cooling ponds. In addition, gates will be installed on the road that would circle the cooling ponds. This would assure a higher degree of protection for the heron rookery inside the proposed FMI than currently exists, especially protection from vandalism and poachers.

4.1.7.2 Threatened, endangered, and state-protected species. Field surveys of birds, plants, insects, amphibians, fish and mammals were conducted by experts in the proposed FMI construction area. These surveys did not identify any protected species in the proposed construction area. The U.S. Fish and Wildlife Service, pursuant to the Fish and

Wildlife Coordination Act and the Endangered Species Act, concluded that measures proposed by DOE would "avoid any impacts to the heron rookery and negate any loss of wetlands."

4.1.7.3 Other species. Minor, localized, short-term impacts on terrestrial and aquatic biota will result from construction. However, after completion of ground-disturbing construction activity, ecological systems would recolonize and restabilize. The precautions taken for the protection of the heron rookery would also provide habitat protection for numerous other organisms resulting in improved biodiversity of the habitat. The amount of wetlands that would be disturbed is less than 6% of the wetlands in the nearby area. The filled wetlands would be mitigated at a ratio of 1:1.5 which would offset any loss of function that the wetland complex in the construction area would experience.

4.2 SHUT DOWN OF MAIN RING

As discussed in Section 2.1.1, the FMI would replace Fermilab's 20-year-old Main Ring. With the exception of new dipole magnets, much equipment from the Main Ring would be reused in the FMI. Other equipment in the Main Ring/Tevatron tunnel would remain in place. (Figure 2.1.1.1 is a photograph of the Main Ring and Tevatron tunnel.) The dipole magnets in the Main Ring would be left in place. This allows the residual radioactivity of the dipole magnets to decay and keeps these units available for future use as new experiments are proposed and approved. Experience with other accelerators has shown that magnets such as those of the Main Ring ultimately find reuse by some other DOE program; however, the forecasting of the timing of such a transfer is sufficiently uncertain that it is impossible to plan the details at this time. Therefore it is judged to be in the best interest of the government to leave the unused Main Ring dipoles in place at the present time.

4.3 NORMAL OPERATIONS OF PROPOSED FMI

4.3.1 Utilities

4.3.1.1 Electricity. As discussed in Section 2.1.2, operation of the FMI would increase Fermilab's power consumption by approximately 25% over that consumed in FY90. Commonwealth Edison Company supplies electricity to Fermilab and to an estimated population of 8 million in an 11,525 square mile area of Northern Illinois. The Company owns and operates the nation's largest network of nuclear facilities. In 1989, 83% of its power was produced using nuclear facilities and the remainder was produced by coal burning facilities. The system's capacity at the time of peak demand was 21,073 megawatts. This was 20% larger than the system's peak demand of 16,785 megawatts. Thus, the Company has a significant amount of excess capacity.

The proposed 345 kV overhead power line for the FMI would be located so that no wetland or floodplain impact would occur. The property on which the line would be located is currently farmed and to the north of Butterfield Road. Concerns have recently arisen at U.S. EPA and in scientific journals about the possible effects of EMF from overhead power lines on human health. The line would be 500' inside the Fermilab site boundary and the closest occupied buildings are at least another 500' south of Butterfield Road. The closest occupied buildings would be 1,000' away from the power line which would assure minimal impact from the 345 kV power line.

4.3.1.2 Primary cooling and distribution systems. As discussed in Section 2.1.2.2, the proposed FMI would be integrated into the site-wide ICW System. A new cooling pond system would be constructed adjacent to the FMI to satisfy the FMI's cooling requirement. FMI operation would not significantly affect Fermilab's ICW cooling water capacity since its demand is offset by the decrease in cooling water requirements as a result of Main Ring shutdown. As further discussed in Section 2.1.2.2, the external beamlines associated with the fixed target program would require increased ICW usage. However, the existing ICW System is adequate to meet this demand. Thus, there would be no significant increase in ICW requirements.

Low Conductivity Water (LCW). As also discussed in Section 2.1.2.2, the proposed system for connecting LCW to the proposed FMI is similar to that used in the Main Ring. Some of the equipment used in the Main Ring LCW system would be reused. Because LCW would not co-mingle with ICW, there is no expected contamination of cooling pond water.

Ventilation, Dehumidification, and Air Conditioning. As discussed in Section 2.1.2.2, because of the relatively few new structures included in the project, FMI operation would not affect Fermilab's existing ventilation, dehumidification, or air conditioning systems or any associated emissions.

4.3.1.3 Domestic water system. Section 2.1.2.3 discusses Fermilab's existing domestic water system. Domestic water requirements for the proposed FMI would be satisfied by connecting the F-0/MI-70 Building, the North Hatch Building and AB-5 to the existing water system. Such extension would not significantly increase Fermilab's domestic water consumption, particularly since, as discussed in Section 2.1.5, FMI operations would not increase the number of Fermilab employees.

4.3.1.4 Sanitary sewer system. As discussed in Section 2.1.2.4, a sanitary sewer line from AB-5 would be the only FMI project connection to Fermilab's existing sanitary sewer system.

4.3.1.5 Telecommunication systems. Section 2.1.2.5 discusses Fermilab's existing telecommunications system as well as the new systems required for FMI operations. The installation of telephone service in FMI tunnels and service buildings would not impact Fermilab's current systems, particularly since no additional Fermilab employees would be required for FMI operations.

4.3.1.6 Conclusion. In summary, any increase in Fermilab's utility requirements as a result of FMI operations would not impair the ability of public utilities to supply their users.

4.3.2 Releases and Waste

4.3.2.1 Air Emissions. As discussed in Section 2.1.3.2, during FMI operations small amounts of radionuclides would be emitted to the atmosphere. Nonradionuclide emissions would also result from several automobiles and light trucks traveling per day to service buildings in the FMI.

Operating with the Main Ring accelerator as the injector to the Tevatron results in an effective dose equivalent at the site boundary of 0.029 mrem using the computer program AIBDOS-PC as specified in the U.S.EPA's NESHAP (40 CFR 61 Subpart H).

The off-site dose rate at the site boundary would be 0.33 mrem/yr under typical operating conditions with the FMI as the injector to the Tevatron. These operating conditions take into account the maximum utilization of the FMI including accidental beam losses. Even with conditions maximized with all accelerators, the dose would be 1 mrem/yr. Both of these rates are well below the NESHAP standard of 10 mrem/yr applicable to members of the general public. They are particularly insignificant when compared with the average annual exposure due to natural background of approximately 300 mrem/yr (National Research Council 1990). The population doses due to the Tevatron operating with the proposed FMI are very small when compared to fluctuations in population doses due to natural background radiations. Therefore, estimates of health effects cannot be performed in a meaningful manner.

Because less maintenance would be required on the FMI than on the Main Ring, FMI operations should reduce nonradionuclide emissions from automobiles or light trucks servicing the FMI. As has been previously mentioned, no increase on the Fermilab work force would be required.

4.3.2.2 Penetrating Radiation. Section 3.9 explains Fermilab's existing program for keeping employee exposures to radiation as low as reasonably achievable. The key aspect of this program is Fermilab's self-imposed guideline of limiting exposures to its employees to less than 2,500 mrem/yr. Section 2.1.3.1 explains how the proposed project is designed with all appropriate shielding to minimize worker and the public's exposure to penetrating radiation. FMI operations, either alone or in combination with existing equipment, would not significantly increase worker exposure to radiation or an exceedance of Fermilab's 2,500 mrem/yr occupational guideline. The radiation exposures to workers due to construction, maintenance, and operation of the FMI are independent of the choice of its location. The design improvements of the FMI and its instrumentation over its predecessor, the Main Ring, will serve to reduce personnel exposures because of better control over beam losses. Exposures to workers will thus continue to be ALARA and are not expected to increase due to the construction, maintenance, and operation of the FMI.

FMI construction would incorporate all appropriate personnel shielding so that there would be no significant increases in Fermilab employee's or the public's exposure to penetrating radiation. Radiation doses have been calculated for normal operations and operations using techniques verified through actual measurement at existing accelerators. These calculations reveal that exposure at the berm surface would be less than 1 mrem/hr for normal operational losses and <10 mrem/hr for above normal losses. Fermilab would restrict access to areas where the proton beam interacts with other material. FMI operations would not result in exposure which would exceed the 2,500 mrem/yr guideline. The current DOE requirements limit the annual effective dose equivalent to workers to 5,000 mrem/year. Existing practices in the Fermilab radiation protection program have served to keep exposures as low as reasonably achievable (ALARA). Indeed, annual effective dose equivalents to occupational workers exceeding 1,000 mrem/yr are quite rare. These ALARA practices will continue during construction and operation of the FMI. Radiation doses at the site boundary are also estimated to be significantly less than 10 mrem/yr for normal operational losses. This estimate includes all pathways of significance. The maximum dose rate due to penetrating radiation at the site boundary will fall rapidly with distance from inverse-square law considerations, and thus, make an insignificant contribution to the effective dose equivalent at the location of the nearest actual residence which is more than 500 meters away from the site boundary in the vicinity of the FMI. The inverse-square dependence will reduce the dose by a factor of more than 300 between the

site boundary and the nearest residence. Likewise, no measurable contribution to the collective dose due to penetrating radiation will result from operations of the FMI.

4.3.2.3 Waste Generation. As discussed in Section 2.1.3.2, FMI operation would not affect Fermilab's volume of regulated chemical waste, which is currently 5-6 truckloads per year, since the FMI would replace the Main Ring. All regulated chemical waste generated as a result of FMI operations would be disposed of in accordance with applicable state and federal regulations and DOE requirements.

FMI operations would likely generate approximately 60 cubic yards per year of low level radioactive material. However, 80% of this volume would be encased in concrete shielding blocks and reused in experiments. Thus, FMI operations would require the disposal of approximate 12 cubic yards of low level radioactive material per year (this is less than 1 additional truckload due to FMI operations), an insignificant amount. With operation of the FMI, Fermilab's disposal of radioactive waste would remain similar to that of a research hospital.

4.3.2.4 Water Quality. As discussed in Section 3.6.2, accelerator operations result in radioactivation of soils near target and beam loss areas on the Fermilab site. These radionuclides could leach to surface water. However, given the design of target and beam loss areas to minimize soil activation, no radionuclides have ever been detected in surface waters or sediments on or near the Fermilab site. Because the same techniques were used in the design of target and beam loss areas in the FMI, none are expected as a result of FMI operations.

As discussed in Section 2.1.3.2, during FMI operations, no water would enter Indian Creek from FMI cooling ponds except during flood conditions. However, the volume of water entering Indian Creek under these conditions would be so large that any heat would be dissipated and the effect on Indian Creek water quality would be insignificant. The cooling pond water would not become contaminated from LCW. These discharges will be covered by a NPDES permit currently in preparation.

As pointed out in 3.2.1, the climate at Fermilab requires addressing the effect of snow and ice storms on the service roads. In order to not increase the salt content of Indian Creek, the Fermilab procedure of selectively using road salt would be modified so that FMI roads would have only sand applied. This would allow maintenance vehicles to proceed safely to the service buildings around the proposed FMI during bad weather.

Effective site restoration would minimize impacts on water quality, thus preventing significant impact on aquatic biota. In summary, FMI operations would have no significant impacts on the quality of surface waters on or near the Fermilab site. Accordingly, FMI operations would not impact aquatic biota or those animals dependent upon them.

4.3.2.5 Groundwater and Soils. During accelerator operations, radioactivation of soils occurs in target and beam loss areas. As discussed in Section 3.7, previous studies have shown that tritium and ^{22}Na are the principal radionuclides of concern at Fermilab. Some soils at the Fermilab site are activated as a result of previous operations. However, this activation has never caused any groundwater contamination.

As discussed in Sections 3.5.1 and 3.7, the Fermilab site is underlain by 65' to 80' of glacial till, primarily of low permeability clay. Although this material forms a barrier

to the downward percolation of any water containing radioactivity, all FMI target stations and beam loss areas have been carefully designed to minimize the risk of groundwater radionuclide contamination. A computer model was employed to calculate the amount of shielding required in the target and beam loss areas to minimize soil activation and to ensure that a hypothetical user drinking 2 liters per day would not receive a committed effective dose equivalent in excess of 4 mrem/yr, which is U.S. EPA's drinking water standard.These controls along with the relatively slow vertically migration time for water in the clay underlying the proposed FMI, will assure that the U.S. EPA's limit of 4 mrem/yr for community wells is met even for a hypothetical single user of a small well drawing its water entirely from the environs of the FMI.

As also discussed in Section 3.8.2, the computer model uses a very conservative approach. For example, it underestimates the substantial reduction in the activity due to downward migration. The Silurian aquifer is the most shallow aquifer used as a source of groundwater near the proposed project. In this area, it lies at a depth of between 65' and 225'. Percolation rates for water in the Fermilab area are estimated to be about 1 meter/yr. Because the half-life of ^{22}Na and tritium are relatively short (2.6 years and 12.3 years, respectively), considerable decay would occur during any downward migration. Accordingly, it is not anticipated that FMI operation would result in any measurable accelerator-produced radioactivity in groundwater.

4.3.3 Work Force

As discussed in Section 2.1.5, it is anticipated that FMI operations would require no additional Fermilab employees. Thus, there would be no impacts to the area's demography or socioeconomic effects from the estimated 20-year operation of the FMI.

4.3.4 Ecology

Operation of the proposed FMI would have little potential for impact on ecological resources beyond those occurring during the construction phase. No bioconcentration of radionuclides would occur; no emissions would be harmful. (See Section 4.2.2.1.)

4.3.5 Land Use

No additional Fermilab employees would be required. FMI operations would not induce any residential or commercial development. The existing Tevatron/Main Ring enclosure would remain intact even after the FMI becomes operational.

4.4 ABNORMAL OPERATIONS

In any facility, the potential always exists for the occurrence of unusual or abnormal events that may have potentially harmful consequences on-site or off-site. Accelerators are classified as "low hazard" facilities because there is no potential for catastrophic consequences from abnormal operations.

Although the Fermilab site is not fenced, it is regulated by a security force. The possibility for sabotage by dissident individuals or groups cannot be overlooked; however, Fermilab is engaged in R&D and continues to maintain an open posture with respect to its endeavors. For this reason, the likelihood of sabotage on the site, and particularly at the proposed FMI facility, is not high and no problem of this nature has occurred in the 20-year life-span of Fermilab. In any case, any potential act of sabotage that could be

sustained by the FMI would involve only the disruption of operations but no detrimental effects to the environment.

Standard fire protection systems would be provided for the FMI in accordance with DOE and National Fire Protection Agency standards. The FMI facilities pose no unusual threat, and no environmental consequences can be foreseen from typical industrial accidents and natural events such as tornadoes and earthquakes.

In a facility such as the FMI, fire, lethal electric shock, and/or a radiation incident could conceivably occur. From the radiation standpoint, there is no potential for catastrophic consequences from any reasonably foreseeable incident. Fermilab's design criteria specify that the largest accidental radiation dose an occupational worker could receive due to operation of the FMI would be less than 100 mrem. This criteria assumes the loss of the entire accelerated beam for a period of one hour at a location where workers could potentially be exposed. Only 2 events of this type have occurred during the 20-year history of Fermilab. The largest accidental radiation dose an occupational worker could receive from the FMI facility will be less than the applicable exposure limit of 5000 mrem/yr for workers in controlled areas (DOE 1988b). Radiation from the FMI would be attenuated by the shielding berm, so that at the site boundary, the dose under this low probability accident scenario would be less than 10 mrem/yr. Such abnormal operations, because of their short duration, do not produce significant amounts of radioactivity in soil or groundwater. Thus, no significant off-site (or on-site) impact from a radiation accident is expected at the FMI.

There is the remote possibility of a tornado strike in the area of the FMI. Section 3.2.1 gives the probability of such an event as once in 6285 years. Most of the FMI is in a tunnel underground, which could serve as a tornado shelter. The plan is to configure the FMI to have entry doors interlocked and a key is contained inside a glass window box at each entry point. In case of a tornado warning, any personnel could approach the nearest service building, break the glass and open the door with the key which would instruct the interlock system to turn off the accelerator, if it was operating. The people would then be safe for the duration of the alert. Since the interlock system is adequately redundant, there is no possibility of anyone entering the tunnel when the beam is on.

4.5 CUMULATIVE CONSTRUCTION AND OPERATIONAL CONSEQUENCES

The following sections evaluate the consequences of the proposed project in conjunction with past operations and reasonably foreseeable future operations at Fermilab.

As discussed above, the proposed FMI would have no effect on groundwater, surface water quality, flooding, hydrology sediments, archaeological or historic resources, utilities, land use, work force, noise, air quality or the ecology of the area. Consequently, there would be no additional impacts on these resources as a result of FMI construction and operation. Moreover, none of the past or current operations at Fermilab have affected the heron rookery. FMI construction and operation would have no cumulative effect on the rookery were the herons to return to this area sometime in the future.

As discussed in Chapters 2 and 3, DOE has employed a very conservative design of existing target and beam loss areas, as well as those proposed for the FMI, to minimize soil activation and to prevent groundwater contamination. Past operations at Fermilab have had no impact on the aquifers in the area. It is anticipated that following FMI operation, there

will continue to be no detectable amounts of accelerator-produced radionuclides in surface waters or their sediments, or groundwaters.

With respect to wetlands, past operations at Fermilab may have created approximately 800 acres of wetlands. The 1964 edition of the Aurora North Quadrangle and the 1962 edition of the Naperville Quadrangle 7.5 Minute Series topographic maps of the U.S.Geological Survey show 100 acres of wetlands on the 6,800 acre site that was to become Fermilab. This data probably underestimates the wetlands that existed at that time. The SSC Environmental Impact Statement listed 900 acres of wetlands on the Fermilab site based on the 1980 and 1982 photographs used in the National Wetland Inventory, U.S. FWS. The proposed FMI construction will result in an overall net increase of 2.90 acres of wetlands at Fermilab. The functional value of the wetlands on the Fermilab property should not significantly change as a result of FMI operation.

The operation of the FMI will increase the power consumption of Fermilab by approximately 25% to 54 megawatts. The offsite dose to a hypothetical individual at the site boundary from Fermilab with the FMI would be 0.33 mrem/yr. The FMI operation would increase the amount of low level radioactive material transported for disposal by 1 truckload to a total of 2 truckload per year.

4.6 DECOMMISSIONING OF THE FMI

It is difficult to predict with any certainty the date for decommissioning the FMI facility because of the conditions described in Section 2.1.6. A detailed decommissioning plan for the FMI would be developed at an appropriate time in the future. The potential environmental consequences associated with FMI decommissioning are discussed generally in this EA. The potential FMI decommissioning impacts would be fully evaluated as necessary in subsequent NEPA documentation. Generally, the potential radiological and non-radiological impacts presented in this section are derived from experience gained in the decommissioning of similar accelerators. Decommissioning of the proposed FMI would have no effects beyond those described below even considering the effects of the decommissioning of the Main Ring.

4.6.1 Nonradiological Effects

Nonradiological effects associated with decommissioning work would be similar to installation of technical components during the construction phase (i.e. noise, dust, and exhaust emissions from carrier-transporting equipment, etc.) (see Section 4.1.5). Environmental impacts from these activities would be temporary and would have no short- or long-term effects on the Fermilab site or neighboring areas. No special or hazardous liquids would be required for this process. Nonradioactive solid materials would be salvaged or disposed of in a permitted sanitary landfill.

No significant impacts on land use are expected. Interim space for temporary storage of excess materials could be allocated in the FMI underground tunnel or in other support buildings. Staging areas for the preparation, packaging, and carrier-loading activities could also be accommodated within the Fermilab facilities. The enclosure and cooling ponds would be left in place, thus avoiding any impacts associated with their removal.

The work force for decommissioning would be small. Similarly, traffic associated with decommissioning would be no greater than that required for construction. Therefore,

there would be no significant socioeconomic impact to the metropolitan Chicago area, and decommissioning would have no significant nonradiological effects.

4.6.2 Radiological Effects

The levels of induced radioactivity in the components of the FMI facility would be available after the surveys described in Section 2.1.6.2. The dominant radioactivities would occur from activation of the iron in the magnets. Most of the products would be short-lived and would decay in-place during the life of the facility. At the end of the estimated 20-year life of the facility, the estimated level of intermediate- and longer-lived radionuclides would be millicurie amounts. These would be fixed within the accelerator components and would decay. The production of radionuclides in other components, such as stainless steel, concrete, and copper, would be at least 10 times lower.

Decommissioning of the FMI accelerator facility can be divided into two categories for radiological consideration: accelerator and shielding components that can be reused at another accelerator facility, and accelerator components that cannot be reused.

Most of the decommissioned accelerator components would be reusable. Reusable components would have either nondetectable or very low activation levels. It is expected that any activation products would be fixed within the materials and, thus, that only minor surface decontamination procedures would be required. Consequently, conventional health physics control procedures for the handling of low-level radiation during storage, shipping, and reinstallation at another location are adequate to ensure no significant environmental impact.

Nonreusable accelerator components are radiologically similar to those that can be reused, but for technical or economic reasons disposal is the preferred option. The proton targets, beam dumps and extraction equipment are expected to be in this category, but they present no unique decontamination and decommissioning problems or potential for significant environmental impact. Conventional health physics surveillance and control during storage and packaging operations and shipment under DOT specifications to a DOE-operated low-level radioactive waste disposal site, are adequate to limit the potential for radiation dose to the public to below permissible levels.

4.7 ALTERNATIVE PROJECT LOCATION

As discussed in Section 2.2.2.1, the only other potentially viable alternative FMI project location is inside the Tevatron. However, this alternative site would disturb a NRHP-certified cultural archaeological site, the only such site on Fermilab property. Since a large portion of the interior of the Tevatron enclosure is classified as wetlands by the U.S. Fish and Wildlife Service National Wetland Inventory maps, the alternative site would require the disturbance of approximately 27 acres of wetlands. (See Figure 2.2.2.1, blue areas.) This potential impact on wetlands is thus much larger than that of the proposed site.

4.8 NO ACTION ALTERNATIVE

The environmental impact of implementing the no action alternative represents a continuation of the current conditions and trends. With or without the FMI, off site there would be continued light industrial and suburban development at current rapid-rate, declining large tract agriculture and pressure for suburbanization. On site there would be

the continued use of Fermilab for high energy research and development. The no action alternative would result in no alteration of wetlands or of the floodplain of Indian Creek. Radioactive air emissions would not increase.

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FEDERAL AND STATE AGENCIES
Permits

Agency	Action Requested
LTC Randall R. Inouye, P.E. Department of Army Chicago District, U.S. Corps of Engineers 111 North Canal Street Chicago, IL 60606-7206	Section 404, Nationwide 26 Permit No. 3499102
Mr. James E. Evans, P.E. Chief, Construction-Operations Division	
Mr. John Rogner (No longer with COE) Chief, Regulatory Functions	
Ms. Pamela Benjamin Regulatory Functions Branch Phone: (312) 353-8213	COE contact person
Ms. Constance Hunt (No longer with COE) Construction Operation Division	Initial COE contact person
Mr. Paul Mauer, Jr., P.E. Illinois Dam Safety Section Illinois Dept of Transportation Division of Water Resources 2300 South Dirksen Parkway Springfield, IL 62764	Section 70 (Flood control) and Section 70a (construction of Class III dam) (Rivers, Lakes and Streams Act)
Mr. Gary Jereb, P.E. Acting Chief Northwestern Illinois Illinois Department of Transporation Division of Water Resources 201 West Center Court Schaumburg, IL 60196-1096	
Mr. Kabbes, P.E. Illinois Dam Safety Section	
Mr. Thomas G. McSwiggin, P.E. Manager, Permit Section Division of Water Pollution Control Illinois Environmental Protection Agency P.O.Box 19276 Springfield, IL 62794-9276	Section 401, Water Quality Certification.

Permits (continued)

Agency	Action Requested
Mr. Bruce Yurdin Division of Water Pollution Control Illinois Environmental Projection Agency 2200 Church Road Springfield, IL 62706	Phone (217) 782-1696
Mr. David Kee Director, Air & Radiation Division U.S. Environmental Protection Agency Region V (5AC-26) 230 South Dearborn Street Chicago, IL 60604 Mr. Michael H. Murphy Air & Radiation Division	Application for Permit to Construct 40 CFR Part 61.07 Radionuclides National Emission Standards for Hazardous Air Pollutions (NESHAP) (312) 353-6686
Donald E. Sutton, P.E. Manager, Permit Section Division of Air Pollution Control Illinois Environmental Protection Agency P.O.Box 19276 2200 Church Road Springfield, IL 62794-9276 Mr. Bhara Mathur, P.E. Acting Manager, Permit Section Division of Air Pollution Control Illinois Environmental Protection Agency 1340 North Ninth Street Springfield, IL 62702	Application for Permit to Construct IL Adm. Code 201.142 NESHAP
Mr. Ronald Darden U.S.Dept of Agriculture Soil Conservation Service 1900 Fox Drive Champaign, IL 61820 Mr. Thomas Ryterske U.S.Dept of Agriculture Soil Conservation Services 2N545 South Randall Road St. Charles, IL 60174	Farmland Conversion Impact Rating

FEDERAL AND STATE AGENCIES
Consultations

Agency	Consultation Requested
Mr. Richard C. Nelson Field Supervisor U.S.Fish and Wildlife Service 1830 Second Avenue, Second Floor Rock Island, IL 61201 Mr. Gerald Bade U.S. Fish and Wildlife Service	Consultation in accordance with Fish and and Wildlife Coordination Act
Mr. Brent Manning, Director Illinois Department of Conservation Lincoln Tower Plaza 424 South Second Springfield, IL 62701-1787	Consultation in accordance with Fish and Wildlife Coordination Act
Mr. Mark Frech	Previous Director
Mr. William Wheeler State Historical Preservation Officer Illinois Historic Preservation Agency Old State Capital Building Springfield, IL 60701 Mr. Theodore W. Hild Deputy State Historic Preservation Officer Ms. Paula Cross Staff Archaeologist	106 Determination of No Effect

FEDERAL AND STATE AGENCIES
Illinois Technology Challenge Grant

Agency	Support
Governor Jim Edgar Office of the Governor State of Illinois Springfield, IL 62706	Recommended acceptance of draft Environmental Assessment
Mr. David Gross Governor's Science Advisory Committee State of Illinois Center 100 West Randolph Street - Suite 11-600 Chicago, IL 60601	
Mr. John J. Straus, Jr. Illinois Dept of Commerce and Community Affairs Office of Technology Advancement and Development State of Illinois Center 100 West Randolph Street - Suite 3-400 Chicago, Illinois 60601	
Ms. Rebecca Lopez, Program Manager Technology Challenge Grant Program State of Illinois Center 100 West Randolph Street - Suite 3-4000 Chicago, IL 60601	Illinois Technology Challenge Grant funding for the Project.
Mr. Steven McClure Director of the Illinois Department of Commerce and Community Affairs 620 East Adams Street Springfield, IL 62706	Illinois Technology Challenge Grant No. (91-82104)
Mr. Frank M. Beaver Illinois Dept of Energy and Natural Resources 325 West Adams Street - Third Floor Springfield, IL 62704	

Consultant

Mr. Robert F. Betz
Northwestern Illinois University
Chicago, Illinois

Ms. Victoria Byre
Chicago Academy of Sciences
2001 North Clark Street
Chicago, IL 60614

Dr. Daniel R. Ludwig
Consulting Mammalogist
P.O.Box 82
Wood Dale, IL 60191

Dr. Rochelle Lurie
Midwest Archaeological Research Services
18906 Hebron Road
Harvard, IL 60033

Mr. Ron Panzer
16248 South Grove Avenue
Oak Forest, IL 60452

Mr. Donald Stillwaugh, Jr.
117A Rob Roy Lane
Prospects Heights, IL 60070

Integrated Lakes Management
90 LeBaron
Waukegan, IL 60085

CONSULTANT SUPPORT

Consultants	Action Requested
Dr. Courtney T. Hackney Coastal Ecologist-Wetland Consultant Route 1, P.O.Box 382R Rocky Point, NC 28457	Corps permit application
Mr. David J. Engel Sidley & Austin One First National Plaza Chicago, IL 60603	Environmental Assessment support
Mr. Nicholas Textor Envirodyne Engineers, Inc. 168 North Clinton Chicago, IL 60606	Corps permit application
Ms. Elisabeth Benjamin Envirodyne Engineers, Inc. 168 North Clinton Chicago, IL 60606	Consultation
Mr. Chris Whelan Morton Arboretum Rte 53 Lisle, IL 60532	Consultation
Dr. Michael D. Wiant Anthropology Section Illinois State Museum Springfield, IL 62706	Consultation on IL-SSC proposal relating to project
Mr. John Kempton Illinois State Geological Survey 615 East Peabody Drive Champaign, IL 61820-7004	Consultation on site soil borings for site characterization
Ms. Patti L. Malmborg State Natural History Survey Division Illinois Dept of Energy and Natural Resources 607 East Peabody Drive Champaign, IL 61820	Consultation

APPENDIX A

CORRESPONDENCE WITH STATE AND FEDERAL

AGENCIES

AUG 1 6 1991

Dr. Dennis Theriot, Associate
Director for Technology
Fermilab
P. O. Box 500
Batavia, Illinois 60510

Dear Dr. Theriot:

SUBJECT: SECTION 404, NATIONWIDE PERMIT NUMBER 26 FOR THE FERMILAB MAIN INJECTOR PROJECT APPLICATION NUMBER 3499102

Attached for your information and use is a signed copy of the subject Department of the Army Permit along with a USCOE Notice of Authorization that must be conspicuously displayed at the work site.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E MRAVCA

Andrew E. Mravca
Area Manager

Enclosure:
As stated

cc: J. Peoples, w/o encl.
K. Stanfield, w/o encl.
S. Holmes, w/o encl.
B. Fowler, w/encl.
D. Cossairt, w/encl.

bc: D. Goldman, OM, w/o encl.
T. Crawford, AMLM, w/o encl.
S. Silbergleid, OCC, w/o encl.
V. Prouty, OCC, w/encl.
N. Hansen, BAO, w/encl.
J. Hess, ER-20, GTN, w/o encl.
J. O'Fallon, ER-22, GTN, w/o encl.
O. Goktepe, ER-22, GTN, w/encl.
J. Farley, ER-8.2, GTN, w/o encl.
C. Hickey, ER-8.2, GTN, w/encl.
G. Charlton, ER-223, GTN, w/o encl.
T. Bhatia, ER-223, GTN, w/encl.
D. Lehman, ER-65, GTN, w/o encl.
S. Tkaczyk, ER-65, GTN, w/o encl.

DEPARTMENT OF THE ARMY PERMIT

Permittee U.S. Department of Energy

Application No. 3499102

Issuing Office Chicago District

DEFINITIONS: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "permit", as used in this authorization, refers to the Department of Army's nationwide permit program. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform the work in accordance with the terms and conditions specified below.

Project Description: Proposed fill of 7.1 acres of wetlands, including 1.4 acres of temporary fill, in the construction of a Main Injector Facility, as described in permit application #3499102, dated January 2, 1990, and plans entitled "Wetlands Impact Plan", dated May 1, 1990 and "Proposed Conditions Plan", dated September 27, 1990.

Project Location: Fermi National Accelerator Laboratory near the town of Batavia, Kane County, Illinois.

Permit Conditions:

General Conditions:

1. The above described work is authorized under the provisions of Nationwide Permit #26 and is therefore subject to all applicable conditions contained in 33 CFR 330 (attached). This verification will be valid until the nationwide permits is modified, reissued, or revoked. All the nationwide permits are scheduled to be modified, reissued or revoked prior to 13 January 1992. It is incumbent upon you to remain informed of changes to the nationwide permits. We will issue a public notice announcing the changes when they occur. Furthermore, if you commence or are under contract to commence this activity before the date the nationwide permits is modified or revoked, you will have twelve months from the date of this modification or revocation to complete this activity under the present terms and conditions of this nationwide permit.

2. You must comply with the Illinois Environmental Protection Agency's conditions (attached), as stated in their December 13, 1990 water quality certification for the project under Section 401 of the Clean Water Act (Public Law 95-217).

Special Conditions:

1. This permit does not obviate the need for you to secure all other permits or authorizations as may be required by local, state and other federal agencies. The responsibility for identifying and securing all such permits or authorizations lies solely with you. Further, this permit is without force or effect until all such other permits or authorizations are secured.

2. You must notify Ms. Pamela Benjamin of the Regulatory Functions Branch, Chicago District, U.S. Army Corps of Engineers, 111 North Canal Street, Chicago, Illinois 60606, telephone number 312/353-8213, at least five days prior to the commencement and completion of work authorized herein.

3. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

4. A detailed mitigation plan, including an implementation plan and schedule of completion, a re-vegetation plan, a five year

management and monitoring plan, a detailed grading plan with appropriate cross sections and a comprehensive erosion control plan, shall be submitted to the Corps of Engineers for review and approval prior to commencement of construction activities.

5. You shall not conduct any construction activities in sensitive areas adjacent to the Heron Rookery during the designated nesting season (15 February - 15 August) until such a time that it has been determined by a qualified person(s) that the Heron have permanently abandoned this site. Documentation of such event must be provided to this office.

6. You must submit any revisions of the engineering or mitigation plans to this issuing office for approval before work is begun.

7. You shall be responsible for all work which is conducted and for ensuring that the contractor and/or workers executing the activity(s) authorized by this permit have knowledge of the terms and conditions of the authorization. The permittee shall insure that a copy of the permit document is at the project site throughout the period work is underway.

8. You shall submit proposed performance standards for wetland revegetation work to this office for review and approval prior to the commencement of construction in wetland. These standards shall include monitoring for at least three complete growing seasons following revegetation. These standards shall be the basis for acceptance of the wetland revegetation mitigation. It shall be the permittee's responsibility to collect all data necessary for the District Engineer to determine compliance with the performance standards. In the event these standards are not met, it shall be the permittee's responsibility to take necessary corrective measures, including but not limited to, replanting and regrading, to comply with the performance standards. The District Engineer's determination is final with respect to acceptance of the wetland revegetation work.

9. All soil erosion control measures shall be properly installed and functioning prior to the commencement of construction.

10. You will arrange to have a qualified person make periodic inspections of the site during construction to ensure that the erosion control measures employed are functioning properly. Inspections will be no less than monthly. Monthly inspections reports detailing the results of the previous month's inspections along with representative photographs, shall be submitted to this office.

11. As-built plans shall be submitted after the construction of the mitigated wetland is complete and prior to seeding.

Further Information:

1. Congressional Authority. You have been authorized to undertake the activity described above pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344).

2. Limits of this authorization.

a. This permit does not grant any property rights or exclusive privileges.

b. This permit does not authorize any injury to the property or rights of others.

c. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. The Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on the behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modifications, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination by the issuing office that this activity complies with terms and conditions of a nationwide permit was made in the reliance on this information you provided.

5. Reevaluation of Permit Decision. The Corps of Engineers may reevaluate its decision on this permit at any time the circumstances warrant. In addition, this office may reevaluate the determination that the project qualifies under a nationwide permit. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (see 4 above).

c. Significant new information surfaces which were not considered in reaching the original interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or that this project no longer qualifies under a nationwide permit and that an individual permit is required.

Your signature below, as a permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE)

July 30, 1991
(DATE)

This authorization becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

(DISTRICT ENGINEER)
Randall R. Inouye, P.E.
Lieutenant Colonel, U.S. Army

13 Aug 91
(DATE)

This notice of authorization must be conspicuously displayed at the site of work.

United States Army Corps of Engineers

19 91

A permit to fill 7.1 acres of wetland, including 1.4 acres of temporary fill

at Fermi National Accelerator Laboratory
Batavia, Kane County, Illinois

has been issued to US Department of Energy on June 26 19 91

Address of Permittee Mr. Andrew Mravca, Area Manager
US Department of Energy, Batavia Area Office
P.O. Box 2000, Batavia, IL 60510

Permit Number

3499102

Randall R. Inouye, P.E.
Lieutenant Colonel, US Army
District Commander

ENG FORM 4336 , Jul 81 (ER 1145-2-303) EDITION OF JUL 70 MAY BE USED (Proponent: DAEN-CWO

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-1696

U.S. Department of Energy (Kane County) Main Injector Facility -- Indian Creek
Loc #C-885-90 [CoE Appl. #3499102]

June 4, 1991

Department of the Army
Chicago District
Corps of Engineers
River Center Building
111 North Canal Street
Chicago, Illinois 60604

Gentlemen:

This Agency received a request on September 11, 1990, from the U.S. Department of Energy requesting necessary comments for environmental consideration concerning the construction of the main injector facility at Fermi National Laboratory, involving the construction in wetlands adjacent to Indian Creek, the relocation of two creek segments and the construction of a wetland mitigation area. We offer the following comments.

Based on the information included in this submittal, it is our engineering judgment that the proposed project may be completed without causing water pollution as defined in the Illinois Environmental Protection Act, provided the project is carefully planned and supervised.

These comments are directed at the effect on water quality of the construction procedures involved in the above described project and is not an approval of any discharge resulting from the completed facility, nor an approval of the design of the facility. These comments do not supplant any permit responsibilities of the applicant towards this Agency.

This Agency hereby issues certification under Section 401 of the Clean Water Act (PL 95-217), subject to the applicant's compliance with the following conditions:

1. The applicant shall not cause:

   a. violation of applicable water quality standards of the Illinois Pollution Control Board, Title 35, Subtitle C: Water Pollution Rules and Regulations;

   b. water pollution as defined and prohibited by the Illinois Environmental Protection Act; and

   c. interference with water use practices near public recreation areas or water supply intakes.

2. The applicant shall provide adequate planning and supervision during the project construction period for implementing construction methods, processes and cleanup procedures necessary to prevent water pollution and control erosion.

3. Any spoil material excavated, dredged or otherwise produced must not be returned to the waterway but must be deposited in a self-contained area in compliance with all State statutes, regulations and permit requirements with no discharge to the waters of the State unless a permit has been issued by this Agency. Any back filling must be done with clean material and placed in a manner to prevent violation of applicable water quality standards.

4. All areas affected by construction shall be mulched and seeded as soon after construction as possible. The applicant shall undertake necessary measures and procedures to reduce erosion during construction. Interim measures to prevent erosion during construction shall be taken and may include the installation of staked straw bales, sedimentation basins and temporary mulching. All construction within the waterway shall be conducted during zero or low flow conditions.

5. The applicant shall implement erosion control measures consistent with the "Standards and Specifications for Soil Erosion and Sediment Control" (IEPA/WPC/87-012).

6. The channel relocation shall be constructed under dry conditions and stabilized to prevent erosion prior to the diversion of flow.

7. This certification becomes effective when the Department of the Army, Corps of Engineers, includes the above conditions #1 through 6 as conditions of the requested permit issued pursuant to Section 404 of PL. 95-217.

This certification does not grant immunity from any enforcement action found necessary by this Agency to meet its responsibilities in prevention, abatement, and control of water pollution.

Very truly yours,

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:BY:jab/1728q/16-17

cc: IEPA, DWPC, Records Unit
DWPC, Field Operations Section, Region 2
IDOT, Division of Water Resources, Schaumburg
USEPA, Region V
U.S. Dept. of Energy
Envirodyne Engineers, Inc.

NATIONWIDE PERMIT 330.5(a)(26) CONDITIONS

DISCHARGES OF DREDGED OR FILL MATERIAL INTO: NON-TIDAL RIVERS, STREAMS, AND THEIR LAKES AND IMPOUNDMENTS, INCLUDING ADJACENT WETLANDS, THAT ARE LOCATED ABOVE THE HEADWATERS; AND OTHER NON-TIDAL WATERS OF THE UNITED STATES, INCLUDING ADJACENT WETLANDS, THAT ARE NOT PART OF A SURFACE TRIBUTARY SYSTEM TO INTERSTATE WATERS OR NAVIGABLE WATERS OF THE UNITED STATES (i.e. ISOLATED WATERS)

1. That the Illinois Environmental Protection Agency has issued water quality certification for the discharge under Section 401 of the Clean Water Act.

2. That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake.

3. That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production.

4. That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act, or destroy or adversely modify the critical habitat of such species.

5. That the activity will not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody.

6. That any discharge of dredged or fill material will consist of suitable material free from toxic pollutants in toxic amounts, pursuant to Section 307 of the Clean Water Act.

7. That any structure or fill authorized will be properly maintained.

8. That the activity will not occur in a component of the National Wild and Scenic River System.

9. That the activity will not cause an unacceptable interference with navigation.

10. That, if the activity may adversely affect historic properties which the National Park Service has listed on, or determined eligible for listing on, the National Register for Historic Places, the permittee will notify the district engineer.

11. That the best management practices listed on Attachment A shall be followed to the maximum extent practicable.

If the above conditions cannot be met an individual or regional permit will be required.

ATTACHMENT A

NATIONWIDE PERMIT MANAGEMENT PRACTICES (33 CFR 330.6)

1. Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

2. Discharges into spawning areas during spawning seasons shall be avoided.

3. Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water unless the primary purpose of the fill is to impound waters.

4. If the discharge creates an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow shall be minimized.

5. Discharges into wetland areas shall be avoided.

6. Heavy equipment working in wetlands shall be placed on mats.

7. Discharges into breeding areas for migratory waterfowl shall be avoided.

8. All temporary fills shall be removed in their entirety.

JUL 3 0 1991

LTC Randall R. Inouye, P.E.
Department of the Army
Chicago District, Corps of Engineers
111 North Canal Street
Chicago, IL 60606-7206

Dear LTC Inouye:

SUBJECT: SECTION 404, NATIONWIDE PERMIT NUMBER 26 FOR THE FERMILAB MAIN INJECTOR PROJECT APPLICATION NUMBER 3499102

Thank you for your June 26, 1991, letter transmitting two copies of the nationwide permit for the subject project. I have signed and I am returning to you both copies of the permit. I understand that upon receipt you will sign and return one copy to me for my records.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA
Andrew E. Mravca
Area Manager

Enclosures:
Two signed copies of Corps 404 permit

cc: P. Benjamin, w/o encl.
J. Peoples, w/o encl.

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO, ILLINOIS 60606-7206

REPLY TO
ATTENTION OF

June 26, 1991

Regulatory Functions Branch
3499102

SUBJECT: Proposed Fill of 7.1 Acres of Wetlands, Including 1.4 Acres of Temporary Fill, in the Construction of the Main Injector Facility at Fermi National Accelerator Laboratory, Batavia, Kane County, Illinois

U.S. Department of Energy
Batavia Area Office
P.O. Box 500, MS #118
Batavia, Illinois 60510

Dear Sir or Madam:

We have received the June 4, 1991 Section 401 water quality certification issued by the Illinois Environmental Protection Agency (IEPA) for your project. This certification was issued in response to our May 7, 1991 acknowledgement letter. Based on our evaluation of the wetland mitigation plan, this office has made the determination that, with special conditions, your project is authorized by the existing Department of the Army nationwide permit found at 33 CFR 330.5(a).

Two copies of your nationwide permit for the subject project are enclosed. If the terms and special conditions of the permit are acceptable, please sign both copies on the line above the word "PERMITTEE" and return them to this office. Upon receipt, I will sign both copies and return one to you for your records.

Please read the permit conditions carefully before signing. Your signature constitutes your specific agreement to all terms and conditions of the permit. Pay particular attention to special condition "1". This permit is without force and effect until all other permits or authorizations from local, state or other federal agencies are secured. Failure to meet any of the conditions may result in the reevaluation of the determination

that the project qualifies under a nationwide permit. If you have any questions about your permit, please contact Ms. Pamela Benjamin of the Regulatory Functions Branch, at 312/353-8213.

Sincerely,

Randall R. Inouye, P.E.
Lieutenant Colonel, U.S. Army
District Engineer

Enclosures

Copies Furnished:

IDOT/DWR (Kabbes)
IEPA (Yurdin)
USFWS (Bade)
Department of Energy (Mravca)
Envirodyne (Benjamin)

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO, ILLINOIS 60606-7206

REPLY TO
ATTENTION OF

7 May 1991

Regulatory Functions Branch
3499102

SUBJECT: The Proposed Construction of the Main Injector Facility at Fermilab located in Sections 25 and 36 of Range 8 East of Township 39N, Batavia Township, Kane County, Illinois

Mr. Andrew E. Mravca, Area Manager
U.S. Department of Energy
Batavia Area Office
P.O. Box 500, MS #118
Batavia, Illinois 60510

Dear Mr. Mravca:

This will acknowledge receipt of your September 10, 1991 permit application for the subject project. Based upon our review of your plans, it is our determination that a Department of the Army authorization under Section 404 of the Clean Water Act will be required.

Before we can process your application, the Illinois Environmental Protection Agency (IEPA) must issue water quality certification under Section 401 of the Clean Water Act. This procedure applies to projects that would affect less than ten acres of isolated waters or waters that are located above the headwaters, which is defined as the point on a stream above which the average annual flow is less than five cubic feet per second. Your project is located above the headwaters of Indian Creek and would affect isolated wetlands in the Indian Creek watershed.

By copy of this letter, IEPA will be informed that water quality certification must be issued before we can process your application. Questions concerning this certification can be addressed directly to Mr. Bruce Yurdin; IEPA; Division of Water Pollution Control; 2200 Churchill Road; Springfield, Illinois 62706; telephone 217/782-1696.

Following the issuance of water quality certification we will decide whether to authorize the project immediately under an existing nationwide permit or to process the application under individual permit procedures. This decision will be made after consulting with the U.S. Fish and Wildlife Service. Based on the proposed mitigation plan, the project will probably qualify for a nationwide permit.

If you have any questions, please contact Ms. Pamela Benjamin of the Regulatory Functions Branch, telephone 312/353-8213.

Sincerely,

John D. Rogner

John D. Rogner
Chief, Regulatory Functions
Branch

Copies Furnished:

IDOT/DWR (Kabbes)
IEPA (Yurdin)
U.S. Development of Energy (Stephen Homes, Project Manager)

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
111 NORTH CANAL STREET
CHICAGO, ILLINOIS 60606-7206

REPLY TO
ATTENTION OF

February 5, 1992

Construction-Operations Division
Regulatory Branch
003499102

SUBJECT: Proposed Fill of 7.1 Acres of Wetlands, Including 1.4 Acres of Temporary Fill, in Association with the Construction of the Main Injector Facility at Fermi National Accelerator Laboratory, Near the Town of Batavia, Kane County, Illinois

Mr. Andrew Mravca
U.S. Department of Energy
Batavia Area Office
P.O. Box 500, MS #118
Batavia, Illinois 60510

Dear Mr. Mravca:

In response to your letter dated December 20, 1991, this office has reviewed and approved the "Wetland Mitigation Plans" submitted on November 18, 1991 and November 21, 1991 for the subject project. Approval of these mitigation plans is in compliance with special conditions 4 and 8 of your Department of the Army permit number 003499102. Any modifications to these plans, however, should be submitted to the Chicago District for re-evaluation.

This office has also reviewed, and has no objections to your request to extend your Department of the Army permit. The extended permit will now expire on June 26, 1993. All other terms and conditions of the original permit remain in full force and effect. Again, any modification to the permitted project will require review and approval by the Chicago District prior to the commencement of the modification activities.

It is your responsibility to obtain any required state or local approvals for the extension, if required, before commencing any work. If you have any questions, please contact Ms. Pamela Benjamin of the Regulatory Branch, telephone number 312/353-8213.

Sincerely,

James E. Evans, P.E.
Chief, Construction-Operations Division

Department of Energy
Batavia Area Office
Post Office Box 2000
Batavia, Illinois 60510

SEP 8 1990

Mr. John Rogner
Acting Chief, Regulatory Functions
U.S. Army Corps of Engineers
111 North Canal Street
Chicago, Illinois 60606-7206

Dear Mr. Rogner:

SUBJECT: U.S. DEPARTMENT OF ENERGY (DOE) REQUEST FOR SECTION 404 NATIONWIDE 26 JOINT PERMIT APPLICATION FOR THE FERMILAB MAIN INJECTOR PROJECT AT FERMI NATIONAL ACCELERATOR LABORATORY

Enclosed for your action is a copy of the subject Joint Permit Application for the Fermilab Main Injector project. By copy of this letter we are forwarding a copy of the permit application to the Illinois Department of Transportation and the Illinois Environmental Protection Agency. This application and the supporting documentation has been reviewed by Courtney T. Hackney, PH.D., Coastal Ecologist - Wetland Consultant.

In addition to applying for the U.S. Army Corps of Engineers (COE) permit, we plan to coordinate other environmental issues with the following organizations:

1. State of Illinois Environmental Protection Agency, Division of Air Pollution Control for an Application of Permit to Construct pursuant to Illinois Administrative Code 201.142 regarding air quality emissions

2. U. S. Environmental Protection Agency for an application for Approval to Construct under Radionuclides National Environmental Standards for Hazardous Air Pollutants (NESHAP), 40 CFR, Part 61; and the

3. Illinois Advisory Council on Historic Preservation and the Illinois State Historical Preservation Officer (SHPO)

Our current plan is to prepare an Environmental Assessment for this project in accordance with the National Environmental Policy Act.

If you have any questions or would like to have a meeting to discuss this Joint Permit Application request, please contact Mr. Norman Hansen, P.E. at (708)840-3281).

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosures:
As stated

cc: Illinois Department of Transportation
Division of Water Resources
2300 South Dirksen parkway
Springfield, IL 62764
Attention: Mr. Paul Mauer, P.E.
Dam Safety Section

Illinois Environmental Protection Agency
Division of Water Pollution Control
2200 Church Road
Springfield, IL 62706
Attention: Mr. Terry A. Sweitzer, P.E.
Manager, Permit Section

bc: Fermilab

J. Peoples
D. Theriot
S. Holmes
W. Fowler

Office of Energy Research

J. O'Fallon, ER-22, GTN
G. Charlton, ER-223, GTN
D. Lehman, ER-65, GTN
J. Farley, ER-NEPA Compliance Officer, ER-8.2, GTN

Chicago Operations Office

D. Goldman, AMLM
N. Hansen, BAO
J. Kennedy, AMSS
M. Flannigan, ESHD
L. Freeman, ESHD
J. Nelsen, CH-NEPA Compliance Officer, ESHD
B. Prouty, OCC
G. Pitchford, OCM

JOINT APPLICATION FORM

1. Application Number (To be assigned by Agency)

2. Date: 5 September 90 (Day / Month / Year)

3. For Agency use only (Date Received)

4. Name and address of applicant:
U. S. Department of Energy
Batavia Area Office
P.O. Box 500 - Mail Stop 118
Batavia, IL 60510
Telephone no. during business hours
A/C (708) 840-3281
A/C ( )

5. Name, address, and title of authorized agent:
Andrew E. Mravca, Area Manager
Batavia Area Office
P.O. Box 500 - Mail Stop 118
Batavia, IL 60510
Telephone no. during business hours
A/C (708) 840-3281
A/C ( )

6. Describe in detail the proposed activity, its purpose, and intended use. If additional space is needed, attach additional support information to each agency application.

See Attachment A

7. Names, addresses, and telephone numbers of all adjoining and potentially affected property owners, including the owner of subject property if different from applicant.

The entire project is within property owned by the Department of Energy. See Attachment B for the list of adjoining and potentially affected property owners.

8. Location of activity
Address:
Fermi National Accelerator Laboratory
Street, road, or other descriptive location
Batavia
In or near city or town
Kane — IL — 60510
County — State — Zip Code

Legal Description:
¼ — 25 & 36 (Sec.) — 39N (Twp.) — 8E (Rge.) — 3 (P.M.)

Tax Assessor's Description (if known):
Map No. — Subdiv. No. — Lot No.

Name of waterway at location of the activity

9. Date activity is proposed to commence 10-1-1991 Date activity is expected to be completed 9-30-1994

10. Is any portion of the activity for which authorization is sought now complete? ___ Yes X No If answer is "Yes" give reasons in the remark section. Month and Year the activity was completed _____ Indicate the existing work on drawings.

11. List all approvals or certifications required by other federal, interstate, State, or local agencies for any structures, construction, discharges, deposits, or other activities described in this application. If this form is being used for concurrent application to the Corps of Engineers, Illinois Department of Transportation, and Illinois Environmental Protection Agency, these agencies need not be listed.

Issuing Agency	Type Approval	Identification No.	Date of Application	Date of Approval
None				

12. Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein.
___ Yes X No (If "Yes", explain in remarks.)

13. Remarks
This application was prepared by Envirodyne Engineers, Inc., 168 N. Clinton, Chicago, IL 60510 ATTN: Nicholas Textor

14. Application is hereby made for authorizations of the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Andrew E. Mravca
Signature of Applicant or Authorized Agent
Andrew E. Mravca, Area Manager

NCR FORM 426
JUNE 81

CORPS OF ENGINEERS COPY - SEE JURISDICTIONAL MAP FOR ADDRESS

Illinois Department of Transportation
Division of Water Resources
2300 South Dirksen Parkway/Springfield, Illinois/62764

October 1, 1990

Mr. Andrew Mravca
U.S. Department of Energy
Batavia Area Office
P.O. Box 500, Mail Stop 118
Batavia, Illinois 60510

RE: Application for Permit
Fermilab Main Injector

Dear Mr. Mravca:

I have reviewed the application and report submitted under copy of your September 6, 1990 letter to Mr. John Rogner of the Corps. As noted under Floodplains on page 6, the report has been reviewed as a preliminary design report.

Based on my review, I have the following comments:

1. The project will be permitted under Sections 70 and 70a of the Rivers, Lakes and Streams Act. Section 70 pertains to obstruction of flood flows. Section 70a pertains to the construction of dams.

2. The project, as proposed, is conceptually acceptable under both Sections. The final issuance of a permit will depend upon the ability to develop final plans and specifications which meet the requirements of the rules.

3. The dam structure is provisionally classified as a small size, Class III dam in accordance with the "Rules for Construction and Maintenance of Dams" (copy enclosed).

As the details of the design are finalized, the materials required for the dam safety permit should be submitted to this office. Those requirements are summarized on pages 25 and 26 of the Rules. Your consultant, Envirodyne Engineers, has worked with this office in the past and is aware of our permit requirements.

If you have any questions regarding this letter, or the requirements for our permit, please contact me at 217/782-3863.

Sincerely,

Paul Mauer, Jr., P.E.
Illinois Dam Safety Section

Encl.

PM:pw/1571R

cc: Mr. Nicholas Textor (Envirodyne Engineers)

Section 702.60 Application for Permit to Construct New Dams or Make Major Modifications to Existing Dams-Contents

Application for a permit shall be made on forms provided by DWR. The application shall include as a minimum:

a) Construction plans and documents, sealed, signed and dated by an engineer stating that the dam design and construction documents have been prepared under his personal supervision and are in conformance with this Part.

b) For all Class I and II dams and for Class III dams where the dam height multiplied by the impounding capacity is greater than 300, computations for structural and geotechnical design of the dam.

c) Computations for the hydrologic and hydraulic design of the spillway or combination of the spillway and the outlet works.

d) For Class I and II dams, computations for the design flood and the 100-year frequency flood routed through the design spillway system.

e) For Class I and II dams, computations for the dam breach wave analysis for downstream impacts.

f) Computations of length of time required to dewater the reservoir, together with a detailed plan indicating methods of dewatering for normal and emergency conditions.

g) Computations for the design of minimum dam height including freeboard.

h) Sketch showing flood plain land use downstream of the dam.

i) Computations for the design of the energy dissipating structures, including an assessment of the impact of the design discharges and other critical flows in downstream channels immediately below the energy dissipators.

j) Time schedule for the construction of the dam (applicant must notify DWR immediately if any advances in the schedule are made).

k) Agreement of the applicant to provide as-built plans and specifications upon completion of construction. These plans and specifications shall be signed by the engineer or other qualified personnel who was responsible for inspection during the construction.

l) For all Class I and II dams, a detailed plan for inspection of the dam and its appurtenances during construction, immediately after completion, at frequent intervals during initial filling of the reservoir, and for a one-year period immediately following completion of the filling. Inspections during the initial filling shall be conducted at least every 30 days. Additional inspections will be required after major storms or seismic events. Following a seismic event, DWR will consult with ESDA and university seismic experts to determine when additional inspections will be required.

m) For all Class I and II dams and for Class III dams where the height multiplied by the impounding capacity is greater than 300, authorization for the State, in the event that the dam is found by DWR to be in imminent danger of failure, to enter upon the dam property if necessary to prevent or alleviate dam breach damage pursuant to Section 702.190, and agreement by applicant to compensate the State for costs reasonably incurred by such emergency action.

n) Right of access authorization for the State to inspect the dam site and immediate vicinity before, during and after construction and for the life of the dam and its appurtenances. DWR shall notify the owner 10 days in advance of any inspection other than an emergency inspection.

o) For Class I and II dams, an operational plan.

p) For all Class I and II dams and for Class III dams where the dam height multiplied by the impounding capacity is greater than 300, a maintenance plan.

q) For Class I and II dams, a financial responsibility statement.

r) Copies of ownership documents or flood easement agreements for all land that will be inundated in the reservoir up to the 100-year frequency flood pool elevation, or hydraulic computations showing no increase in the flood pool elevations above existing conditions for floods up to the 100-year frequency flood.

Department of Energy
Batavia Area Office
Post Office Box 2000
Batavia, Illinois 60510

JAN 2 9 1992

Mr. Paul Mauer, Jr., P.E.
Illinois Dam Safety Section
Illinois Department of Transportation
Division of Water Resources
2300 South Dirksen Parkway
Springfield, Illinois 62764

Dear Mr. Mauer:

SUBJECT: U.S. DEPARTMENT OF ENERGY REQUEST FOR SECTION 404, NATIONWIDE 26, JOINT PERMIT APPLICATION FOR THE MAIN INJECTOR PROJECT AT FERMILAB

On September 6, 1990, we submitted a Section 404, Nationwide 26, Joint Permit Application for the project to the U.S. Corps of Engineers (COE), Illinois Environmental Protection Agency (IEPA) and Illinois Department of Transportation (IDOT), Division of Water Resources (DWR).

On October 1, 1990, we received your letter stating the permit was conceptually acceptable under Section 70 and 70A of the Rivers, Lakes, and Streams Act. The Section 401 water quality certification was received from the IEPA on June 4, 1991, and the COE issued a 404 Permit on June 26, 1991.

We have incorporated the above guidance into a Fermilab Main Injector Project Wetland Mitigation package which involves construction work in the Indian Creek floodplain. It does not include any items related to the construction of the dam at this time. There is no regulatory floodway defined in this portion of Indian Creek. The wetland mitigation includes provisions for compensatory floodplain storage. The wetland mitigation package was prepared by Flour-Daniel, Inc. A copy of the package has been provided to the COE under a separate cover letter. At the request of Nick Textor, Envirodyne Engineers, Inc., I am also providing a copy to your Schaumburg Office.

Would you please review the enclosed wetland mitigation package and provide this office your comments.

Sincerely,

James A. Mulkey

Andrew E. Mravca
Area Manager

Enclosure:
Wetland mitigation package

cc: Gary Jereb, IDOT, Schaumburg, w/encl.
Nick Textor, Envirodyne Engineers, w/o encl.

Illinois Department of Transportation
Division of Water Resources
3215 Executive Park Drive / P.O. Box 19484 / Springfield, Illinois / 62794-9484

January 31, 1992

Mr. Andrew Mravca
U.S. Department of Energy
Batavia Area Office
P.O. Box 2000
Batavia, Illinois 60510

Dear Mr Mravca:

I have reviewed your January 29, 1992 submittal regarding the wetlands mitigation package. I concur with your statement that none of the dam construction portion of the Main Injector Project are included in this package. Thus, the package will not require review by the dam safety section.

The wetlands mitigation package does include work in the floodway of Indian Creek. Because there is no defined regulatory floodway for this portion of Indian Creek, the work will be reviewed under Section 70 of the Rivers, Lakes and Streams Act rather than under Section 65g. Section 70 requires only that there be no unmitigated offsite impacts. While some additional documentation may be required, the nature of the proposed work indicates no conceptual conflicts with Section 70.

All subsequent review of the wetlands mitigation package will be handled by our Schaumburg office. Questions regarding review of that package should be referred directly to that office. Questions regarding the dam safety aspects of the Injector Project should continue to be directed to this office.

Sincerely,

Paul Mauer

Paul Mauer, Jr., P.E.
Dam Safety Section

PM:crn
cc: Gary Jereb
Nicholas Textor

JUL 1 1 199?

John R. O'Fallon, Director
Division of High Energy Physics
ER-22 GTN

SUBJECT: DOE NOTICE OF FLOODPLAIN AND WETLAND INVOLVEMENT NOTIFICATION FOR PROPOSED CONSTRUCTION OF THE MAIN INJECTOR AT FERMILAB

The subject notice was published in the Federal Register on Tuesday June 11, 1991, with comments due to this office on or before June 26, 1991. During the U.S. Corps of Engineers (COE) site visit to Fermilab on June 20, 1991, the COE representative said that they were reviewing the notice and would respond if they had any comments.

The purpose of this memorandum is to advise you that this office did not receive any comments as a result of the public notice published in the Federal Register.

Original Signed by
James A. Miller

Andrew E. Mravca
Area Manager

cc: W. Hess, ER-20, GTN
O. Goktepe, ER-22, GTN
G. Charlton, ER-223, GTN
J. Farley, ER-8.2, GTN
C. Hickey, ER-8.2, GTN
D. Goldman, OM
C. Richardson, AMLM
J. Nelsen, ESHD
S. Silbergleid, OCC
V. Prouty, OCC

DEPARTMENT OF ENERGY

Floodplain and Wetland Involvement Notification for Proposed Construction of the Main Injector at Fermi National Accelerator Laboratory, Batavia, IL

AGENCY: Department of Energy.

ACTION: Public notice of comment period on floodplain/wetland involvement.

SUMMARY: The Department of Energy (DOE) proposes to construct a 150 GeV (Giga electron Volt) proton synchrotron (Main Injector) at Fermi National Accelerator Laboratory, which is situated on Federally owned lands under the jurisdiction of the U.S. Department of Energy (DOE). All activities related to the proposed project will occur within a restricted area of approximately 135 acres on the Federally owned property.

In accordance with the DOE Regulations for Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR part 1022), DOE will prepare a floodplain and wetland assessment to be incorporated in the appropriate National Environmental Policy Act document for the proposed action. DOE's decision concerning the floodplain/wetlands action would be documented in a statement of findings and incorporated into DOE's finding of no significant impact or environmental impact statement, as appropriate.

DATES: Any comments are due on or before June 26, 1991.

ADDRESS: Send written comments to Andrew E. Mravca, Area Manager, P.O. Box 2000, Batavia, Illinois 60510.

SUPPLEMENTARY INFORMATION: The proposed Main Injector would provide a national facility for advancing the frontiers of high-energy particle physics research. The Main Injector would be an oval-shaped below grade enclosure with a circumference of about 10,900 feet. The Main Injector construction would also include construction of a shielding berm around the below grade enclosure, cooling ponds around much of the shielding berm, a 345 kV overhead power line, several service buildings around the enclosure, and an industrial building for component fabrication and assembly of many of the Main Injector magnets. Construction would require the filling of portions of five wetland areas which are seasonally or intermittently flooded. Three wetlands are palustrine forested wetlands, one is a lower perennial riverine wetland and another is a palustrine emergent wetland. The five wetlands total 87.60 acres in size; 7.14 acres would be filled during construction, but only 5.70 acres of fill would be permanent. Main Injector construction would also fill a portion of the existing 100-year floodplain of Indian Creek, a tributary of the Fox River. The flow of Indian Creek and its tributaries would be temporarily diverted during construction to keep immediate construction areas dry. Normal water levels would be restored when construction work in the Indian Creek area is completed. Portions of Indian Creek flow would be diverted around the Main Injector during flood conditions. The flow would be diverted into and through two cooling ponds. In accordance with DOE's regulations for compliance with floodplain/wetlands environmental review requirements (10 CFR part 1022), DOE will prepare a floodplain/wetlands assessment. Consultations with the U.S. Army Corps of Engineers (COE) and the Illinois Department of Transportation/Division of Water Resources (IDOT/DWR) have been initiated, and required permit applications and mitigation plans have been submitted for approval by the appropriate agency.

A replacement wetland (totaling 8.55 acres) is proposed to be constructed adjacent to Indian Creek; therefore, the new wetland is proposed to be constructed in the same watershed as the wetlands that would be disturbed. The area proposed for the replacement wetland supports hydric soils and would be graded to match the grade of the adjacent wetland to insure sufficient hydrology is obtained for wetland establishment and success. Soil removed from the disturbed wetlands would be utilized to provide a seedbank for the created wetland area. Additionally, saplings of silver maple and other species, such as box elder and green oak that are characteristic of adjacent wetlands, would be planted. The proposed project also would include the creation of 29 acre-feet of floodwater storage capacity to compensate for construction of the Main Injector within the floodplain. DOE proposes to maintain the existing watershed characteristics within the project site and the surrounding areas. Detailed engineering specifications for the proposed replacement wetland would be provided to the COE prior to construction, and a 5-year monitoring program would document the wetland mitigation area according to appropriate performance criteria. Maps and further

information are available from the address shown above.

James F. Decker,

Acting Director, Office of Energy Research.

[FR Doc. 91-13724 Filed 6-10-91; 8:45 am]

BILLING CODE 6450-01-M

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

MAY 09 1991

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

REPLY TO ATTENTION OF:
(5AT-26)

Mr. Andrew E. Mravca
Department of Energy Area Manager
Batavia Area Office
P.O. Box 2000
Batavia, Illinois 60510

Re: Application for Approval to Construct the Fermilab Main Injector

Dear Mr. Mravca:

Thank you for your submittal on February 28, 1991, of an application to construct, under 40 CFR Part 61.07, a 150 GeV proton synchrotron, the Fermilab Main Injector at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, Illinois by the United States Department of Energy (USDOE). In accordance with the provisions of 40 CFR Part 61, the United States Environmental Protection Agency (USEPA) has reviewed the application to determine whether the Fermilab Main Injector will cause emissions in violation of the radionuclides emissions standard promulgated at 40 CFR Part 61, Subpart H (radionuclides standard).

USEPA has determined that the data contained in the application indicate that the Main Injector will not cause emissions in violation of the radionuclides standard if properly operated. USEPA hereby approves this construction in accordance with 40 CFR 61.08.

Please be advised that this approval is granted solely under Section 112 of the Clean Air Act and the General Provisions of 40 CFR Part 61, and does not relieve you of the responsibility for compliance with any other provisions of 40 CFR Part 61, or other applicable Federal, State, or local regulations. In addition, this approval in no way affects approvals under other Federal or State authorities.

Any questions concerning this approval may be directed to Michael H. Murphy, of my staff, at (312) 353-6686.

Sincerely yours,

David Kee, Director
Air and Radiation Division

FEB 2 8 1991

Mr. David Kee
Director, Air and Radiation Division
United States Environmental Protection Agency
Region V (5AC-26)
230 South Dearborn Street
Chicago, IL 606004

Dear Mr. Kee:

The U. S. Department of Energy proposes to construct a 150 GeV proton synchrotron, the Fermilab Main Injector, at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, IL. Please find enclosed an application for Approval to Construct the Fermilab Main Injector submitted under the Radionuclides National Emission Standards for Hazardous Air Pollutants, 40 CFR part 61.07.

Concurrently, I am submitting an application for a Permit to Construct the Fermilab Main Injector to the Illinois Environmental Protection Agency (IEPA) in accord with 40 CFR Part 61 and 35 Ill. Adm. Code 201.142.

Attached is a technical analysis of the quantities of radionuclides expected to be emitted. Briefly, the maximum effective dose equivalent estimated to be delivered to the nearest off-site resident is extremely low, less than 1 mrem/year. This level is small compared with the limit of 10 mrem/year to members of the public specified in 40 CFR 61 Subpart H. Based on the information provided in this application, approval by your office to construct the Fermilab main Injector is requested. The construction of this accelerator is scheduled to begin October 1, 1991, with its initial operation scheduled to begin in October 1995.

If you have any questions or if you would like to meet to discuss this permit action, please contact me. I appreciate your cooperation in this manner.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA
Andrew E. Mravca
Area Manager

Enclosure:
As stated

cc: B. Mathur, IEPA, w/o encl.

bc: S. Holmes, Fermilab, w/o encl.
J. Peoples, Fermilab, w/o encl.
D. Theriot, Fermilab, w/o encl.
D. Cossairt, Fermilab, w/o encl.
N. Hansen, BAO, w/o encl.
M. Flannigan, ESHD, w/encl.
M. Johnson, AMLM, w/encl.

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-2113

CONSTRUCTION PERMIT -- NESHAP SOURCE RADIONUCLIDE EMISSIONS

PERMITTEE

U.S. Department of Energy - Fermilab
Attn: Andrew E. Mravca
Wilson Street
Batavia, Illinois 60510

Application No.: 91030001
Applicant's Designation: RAD STACKS
Subject: Radionuclide Emission Stacks
Date Issued: January 21, 1992
Location: Wilson Street, Batavia

I.D. No.: 043807AAI
Date Received: January 13, 1992

Permit is hereby granted to the above-designated Permittee to construct emission source(s) and/or air pollution control equipment consisting of proton synchrotron main injector as described in the above referenced application. This Permit is subject to standard conditions attached hereto and the following special conditions:

1a. This Department of Energy facility (DOE) is subject to a National Emission Standard for Hazardous Air Pollutants (NESHAP) for radionuclide emissions, 40 CFR 61, Subparts A and H.

b. Pursuant to the National Emission Standard for Hazardous Air Pollutants, emissions of radionuclides shall not exceed those amounts that would cause in any year an effective dose equivalent of 10 mrem/yr to any member of the public.

c. At all times, the permittee shall also, to the extent practicable, maintain and operate the plant, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions.

2a. The permittee shall demonstrate compliance with NESHAP using the procedures specified by 40 CFR 61.93.

b. The permittee shall fulfill applicable notification, compliance and reporting, and recordkeeping requirements of the NESHAP, 40 CFR 61.09, 61.94 and 61.95.

c. Any required reports and notifications concerning equipment operation, performance testing or a continuous monitoring system shall be sent to the Agency's regional office at the following address unless otherwise indicated:

Illinois Environmental Protection Agency
Division of Air Pollution Control
The Intercontinental Center
1701 First Avenue
Maywood, Illinois 60153

3. This permit will expire on April 1, 1993, unless a continuous program of construction or development on this project has started by such time.

It should also be noted that this permit has been modified to extend the expiration date.

It should be noted that the United States Environmental Protection Agency also administers the federal NESHAP standards for radionuclides, so that compliance with these standards, including Approval of Construction, 40 CFR 61.10 Source Reporting, and 61.94(c), Reporting must also be demonstrated to USEPA.

Donald E. Sutton/kbc

Donald E. Sutton, P.E.
Manager, Permit Section
Division of Air Pollution Control

DES:MSH:sap/0906q,7-8

cc: IEPA, FOS, Region 1
IEPA, FOS, CMU
USEPA

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
2200 CHURCHILL ROAD
SPRINGFIELD, ILLINOIS 62706

STANDARD CONDITIONS FOR CONSTRUCTION/DEVELOPMENT PERMITS ISSUED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

July 1, 1985

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) authorizes the Environmental Protection Agency to impose conditions on permits which it issues.

The following conditions are applicable unless susperseded by special condition(s).

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time.

2. The construction or development covered by this permit shall be done in compliance with applicable provisions of the Illinois Environmental Protection Act and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

4. The permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times:

   a. to enter the permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit,

   b. to have access to and to copy any records required to be kept under the terms and conditions of this permit,

   c. to inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit,

   d. to obtain and remove samples of any discharge or emissions of pollutants, and

   e. to enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

5. The issuance of this permit:

   a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located,

   b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities,

   c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations,

   d. does not take into consideration or attest to the structural stability of any units or parts of the project, and

e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.

6. a. Unless a joint construction/operation permit has been issued, a permit for operation shall be obtained from the Agency before the equipment covered by this permit is placed into operation.

   b. For purposes of shakedown and testing, unless otherwise specified by a special permit condition, the equipment covered under this permit may be operated for a period not to exceed thirty (30) days.

7. The Agency may file a complaint with the Board for modification, suspension or revocation of a permit:

   a. upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed, or

   b. upon finding that any standard or special conditions have been violated, or

   c. upon any violations of the Environmental Protection Act or any regulation effective thereunder as a result of the construction or development authorized by this permit.

DIRECTORY
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL

July 1, 1985

For assistance in preparing a permit application contact the Permit Section,

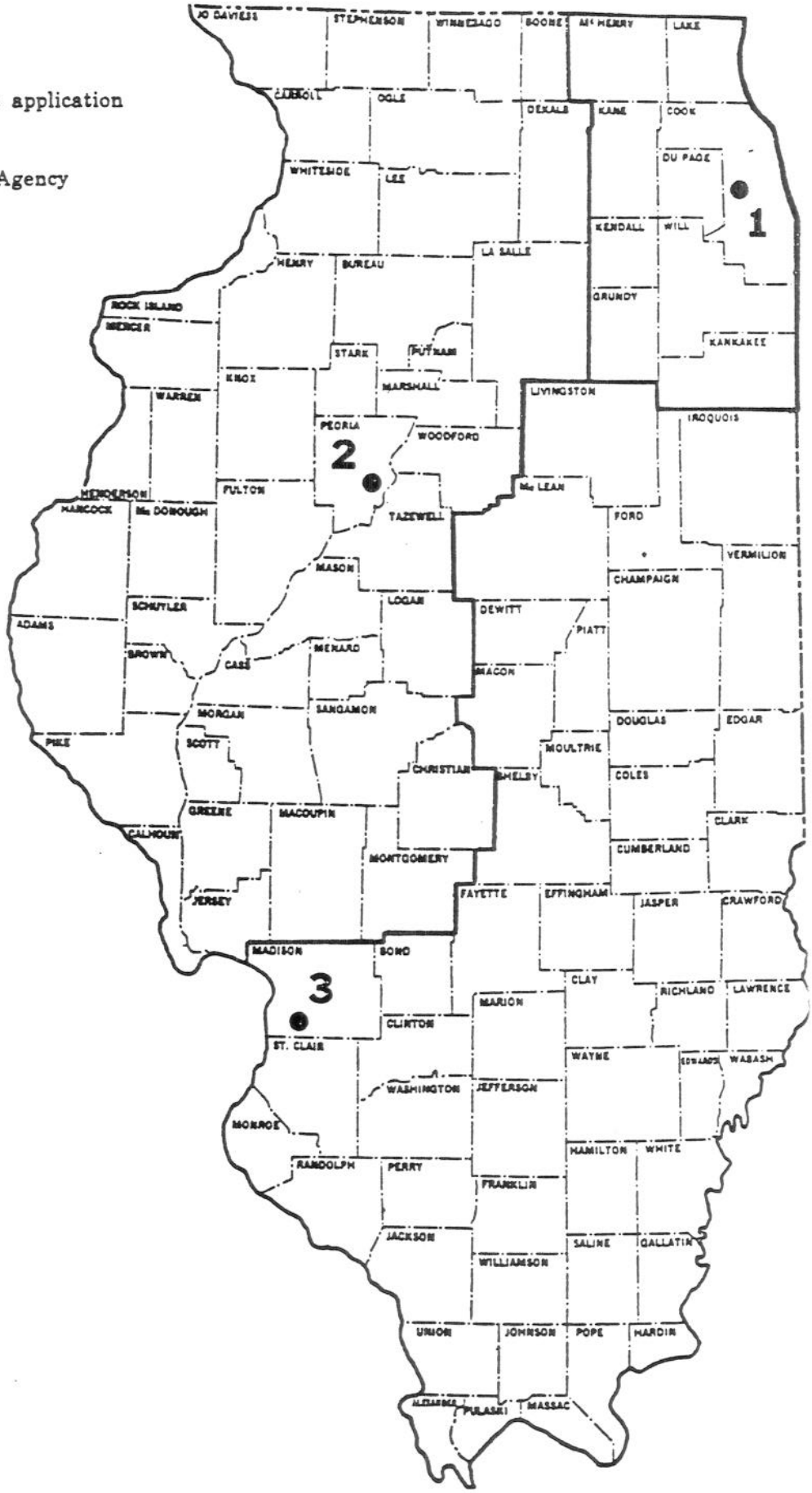
Illinois Environmental Protection Agency
Division of Air Pollution Control
Permit Section
2200 Churchill Road
Springfield, Illinois 62706
(217) 782-2113

or a regional office of the Field Operations Section. The regional offices and their areas of responsibility are shown on the map. The addresses and telephone numbers of the regional offices are as follows:

Illinois EPA
Region 1
Intercontinental Center
1701 S. 1st Avenue
Maywood, Illinois 60153
(312) 345-9780

Illinois EPA
Region 2
5415 North University
Peoria, Illinois 61614
(309) 691-2200

Illinois EPA
Region 3
2009 Mall Street
Collinsville, Illinois 62234
(618) 345-0700



Printed on Recycled Paper

January 8, 1992

Donald E. Sutton, P.E.
Manager, Permit Section
Division of Air Pollution Control
Illinois Environmental Protection Agency
P.O. Box 19276
2200 Churchill Road
Springfield, Illinois 62794-9276

Dear Mr. Sutton:

SUBJECT: ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA) CONSTRUCTION PERMIT FOR THE FERMILAB MAIN INJECTOR AT FERMI NATIONAL ACCELERATOR LABORATORY (FERMILAB)

Reference: Subject Application No.: 91030001; I.D. No.: 043807AAI

During February 1991, the United States Department of Energy (DOE) submitted to your Agency an application for a permit to construct a 150 GeV proton synchrotron, the Fermilab Main Injector (FMI), at Fermilab in Batavia, Illinois. We submitted the application under the radionuclides National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 61). Your office issued the above-referenced permit on April 1, 1991. This permit incorporates the following standard condition:

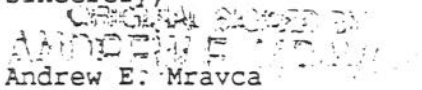
> "Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time."

At the time that the original permit application was filed, it was anticipated that construction of the FMI would begin October 1, 1991. Delays in the release of funding for this project have made the start of construction of the FMI by April 1, 1992, unlikely.

The design of the FMI has not been altered in any way which changes the emissions of radionuclides or exposures to members of the public or employees of the facility described in the original permit application and its supporting documentation. I am therefore requesting a one-year extension of this construction permit (i.e., until April 1, 1993) in order to accommodate the revised construction schedule resulting from funding delays.

Please contact Mr. Jon Cooper of my staff at (708) 840-3281 if you have questions regarding this request. Thank you.

Sincerely,



Andrew E. Mravca
Area Manager

cc: D. Cossairt, Fermilab

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-2113

CONSTRUCTION PERMIT -- NESHAP SOURCE RADIONUCLIDE EMISSIONS

PERMITTEE

U.S. Department of Energy - Fermilab
Attn: Andrew E. Mravca
Wilson Street
Batavia, Illinois 60510

Application No.: 91030001
I.D. No.: 043807AAI
Applicant's Designation: RAD STACKS
Date Received: March 1, 1991
Subject: Radionuclide Emission Stacks
Date Issued: April 1, 1991
Location: Wilson Street, Batavia

Permit is hereby granted to the above-designated Permittee to construct emission source(s) and/or air pollution control equipment consisting of proton synchrotron main injector as described in the above referenced application. This Permit is subject to standard conditions attached hereto and the following special conditions:

1a. This Department of Energy facility (DOE) is subject to a National Emission Standard for Hazardous Air Pollutants (NESHAP) for radionuclide emissions, 40 CFR 61, Subparts A and H.

b. Pursuant to the National Emission Standard for Hazardous Air Pollutants, emissions of radionuclides shall not exceed those amounts that would cause in any year an effective dose equivalent of 10 mrem/yr to any member of the public.

c. At all times, the permittee shall also, to the extent practicable, maintain and operate the plant, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing emissions.

2a. The permittee shall demonstrate compliance with NESHAP using the procedures specified by 40 CFR 61.93.

b. The permittee shall fulfill applicable notification, compliance and reporting, and recordkeeping requirements of the NESHAP, 40 CFR 61.09, 61.94 and 61.95.

c. Any required reports and notifications concerning equipment operation, performance testing or a continuous monitoring system shall be sent to the Agency's regional office at the following address unless otherwise indicated:

Illinois Environmental Protection Agency
Division of Air Pollution Control
The Intercontinental Center
1701 First Avenue
Maywood, Illinois 60153

It should be noted that the United States Environmental Protection Agency also administers the federal NESHAP standards for radionuclides, so that compliance with these standards, including Approval of Construction, 40 CFR 61.10 Source Reporting, and 61.94(c), Reporting must also be demonstrated to USEPA.

B. Mathur

Bharat Mathur, P.E.
Acting Manager, Permit Section
Division of Air Pollution Control

BM:MSH:sap/0906q,7-8

cc: IEPA, FOS, Region 1
IEPA, FOS, CMU
USEPA

STATE OF ILLINOIS
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL
2200 CHURCHILL ROAD
SPRINGFIELD, ILLINOIS 62706

STANDARD CONDITIONS FOR CONSTRUCTION/DEVELOPMENT PERMITS ISSUED BY THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

July 1, 1985

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1/2, Section 1039) authorizes the Environmental Protection Agency to impose conditions on permits which it issues.

The following conditions are applicable unless susperseded by special condition(s).

1. Unless this permit has been extended or it has been voided by a newly issued permit, this permit will expire one year from the date of issuance, unless a continuous program of construction or development on this project has started by such time.

2. The construction or development covered by this permit shall be done in compliance with applicable provisions of the Illinois Environmental Protection Act and Regulations adopted by the Illinois Pollution Control Board.

3. There shall be no deviations from the approved plans and specifications unless a written request for modification, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.

   The permittee shall allow any duly authorized agent of the Agency upon the presentation of credentials, at reasonable times:

   a. to enter the permittee's property where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit,

   b. to have access to and to copy any records required to be kept under the terms and conditions of this permit,

   c. to inspect, including during any hours of operation of equipment constructed or operated under this permit, such equipment and any equipment required to be kept, used, operated, calibrated and maintained under this permit,

   d. to obtain and remove samples of any discharge or emissions of pollutants, and

   e. to enter and utilize any photographic, recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

5. The issuance of this permit:

   a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located,

   b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities,

   c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations,

   d. does not take into consideration or attest to the structural stability of any units or parts of the project, and

DIRECTORY
ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL

July 1, 1985

For assistance in preparing a permit application contact the Permit Section,

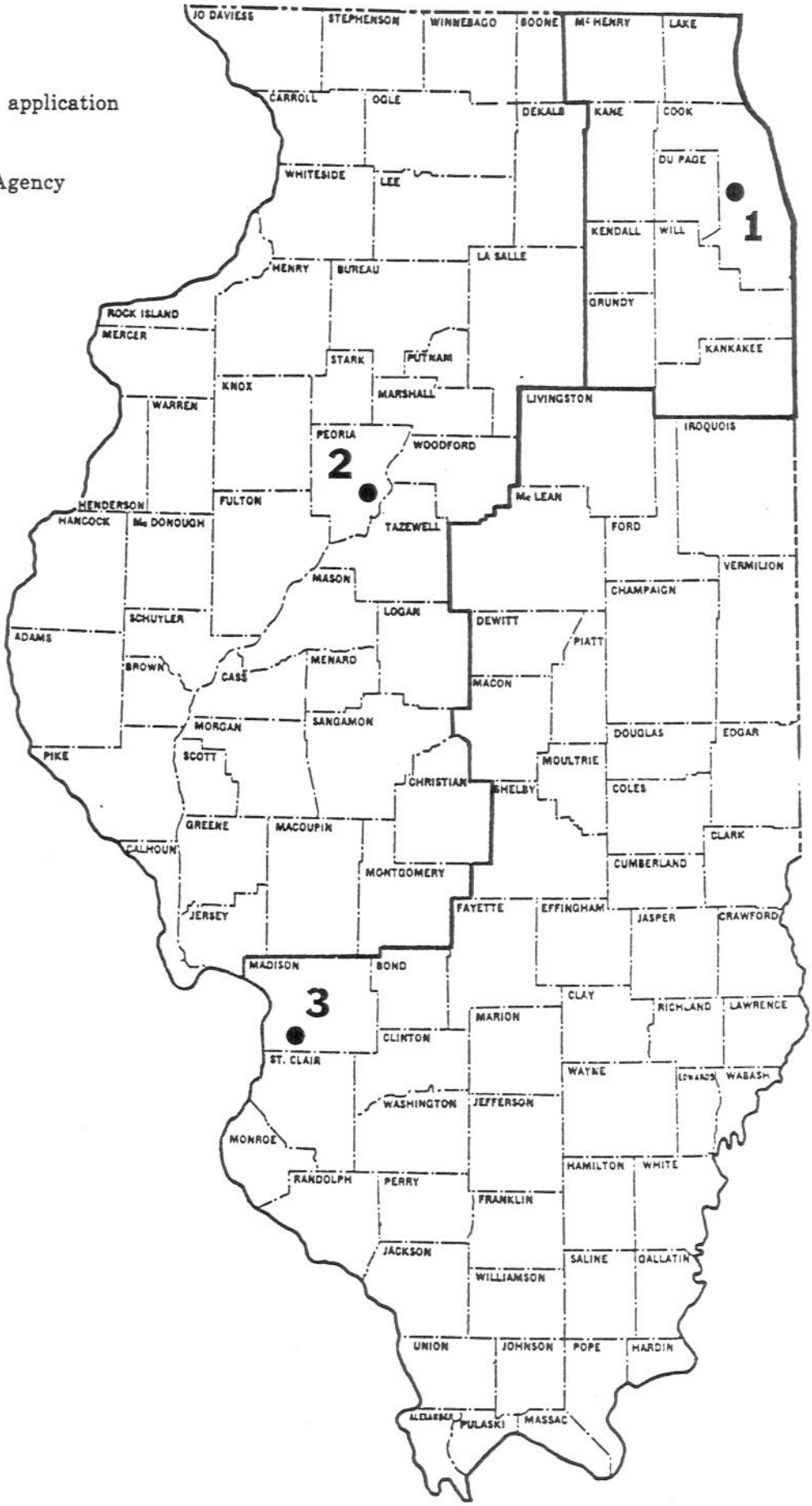
Illinois Environmental Protection Agency
Division of Air Pollution Control
Permit Section
2200 Churchill Road
Springfield, Illinois 62706
(217) 782-2113

or a regional office of the Field Operations Section. The regional offices and their areas of responsibility are shown on the map. The addresses and telephone numbers of the regional offices are as follows:

Illinois EPA
Region 1
Intercontinental Center
1701 S. 1st Avenue
Maywood, Illinois 60153
(312) 345-9780

Illinois EPA
Region 2
5415 North University
Peoria, Illinois 61614
(309) 691-2200

Illinois EPA
Region 3
2009 Mall Street
Collinsville, Illinois 62234
(618) 345-0700



FEB 1 0 1991

Mr. Bharat Mathur, ~~Chief~~ P. E.
Acting Manager, Permit Section
Division of Air Pollution Control
Illinois Environmental protection Agency
1340 North Ninth Street
Springfield, Illinois 62702

Dear Mr. Mathur:

The U. S. Department of Energy proposes to construct a 150 GeV proton synchrotron, the Fermilab Main Injector at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, IL. Please find enclosed an application for Permit to Construct the Fermilab Main Injector submitted under the radionuclides National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR part 61 and 35 Ill. Adm. Code 201.142). The construction of this accelerator is scheduled to begin October 1, 1991 with is initial operation scheduled to begin October 1, 1995.

Enclosed are both the application forms and a technical analysis of the quantities of radionuclides expected to be emitted. Briefly, the maximum effective dose equivalent estimated to be delivered to the nearest off-site resident is extremely low, less than 1 mrem/year. This level is small compared with the limit of 10 mrem/year to members of the public specified in 40 CFR 61 Subpart H. Based on the information provided in this application, approval by your office to construct the Fermilab Main Injector is requested.

Present Fermilab accelerator operations under this NESHAP are covered by IEPA Permit Application No. 89080089 I.D. No. 043807AAI which was issued October 30, 1989 and has an initial expiration date of August 28, 1994. Until the Fermilab Main Injector is operational, the high energy physics research program using the existing accelerator complex will continue under the conditions of the present permit. Given the schedule of this construction project, the scope of accelerator operations including the Fermilab Main Injector will be included in the application for renewal of Permit Application No. 89080089 I.D. No. 043807AAI.

Concurrently, I am submitting an application for an Approval to Construct the Fermilab Main Injector to the United States Environmental Protection Agency (USEPA) under 40 CFR Part 61.07.

If you have any questions or if you would like to meet to discuss this permit action, please contact me. I appreciate your cooperation in this matter.

Sincerely,

Andrew E. Mravca
Area Manager

Enclosure:
As stated

cc: D. Key, USEPA, w/o encl.

bc: S. Holmes, Fermilab, w/o encl.
J. Peoples, Fermilab, w/o encl.
D. Theriot, Fermilab, w/o encl.
D. Cossairt, Fermilab, w/o encl.
N. Hansen, BAO, w/o encl.
M. Flannigan, ESHD, w/encl.
M. Johnson, AMLM, w/encl.

AUG 3 0 1991

Mr. Ronald Darden
U.S. Department of Agriculture
Soil Conservation Service
1900 Fox Drive
Champaign, Illinois 61820

SUBJECT: FARMLAND CONVERSION IMPACT RATING

Dear Mr. Darden:

The Department of Energy proposes to construct a 150 GeV proton synchrotron (Main Injector) at Fermi National Accelerator Laboratory (Fermilab). All the proposed project activities will be restricted to approximately 135 acres of the forest and vacant grassland in the southwest corner of the Fermilab site. (See location of project on the attached map.)

Pursuant to the Farmland Protection Policy Act (FPPA), we have attached Form AD-1006, Farmland Conversion Impact Rating. We believe the proposed Fermilab Main Injector Project site does not contain prime, unique, statewide or local important farmland. I would appreciate receiving your determination at your earliest convenience.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosures:
Form AD-1006
Site map

cc: Mr. Thomas Ryterske
U.S. Department of Agriculture
Soil Conservation Service
2N545 South Randall Road
St. Charles, IL 60174

J. Peoples, Fermilab, w/o encl.
K. Stanfield, Fermilab, w/o encl.
B. Chrisman, Fermilab, w/o encl.
D. Theriot, Fermilab, w/encl.
S. Holmes, Fermilab, w/o encl.
W. Fowler, Fermilab, w/encl.

bc: D. Goldman, OM, CH, w/o encl.
S. Barish, AMLM, w/o encl.
W. Hess, ER-20, GTN, w/o encl.
J. O'Fallon, ER-22, w/o encl.
O. Goktepe, ER-22, w/encl.
G. Charlton, ER-223, GTN, w/o encl.
T. Bhatia, ER-223, GTN, w/encl.
C. Hickey, ER-8.2, GTN, w/o encl.
S. Tkaczyk, ER-65, GTN, w/encl.

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request: August 6, 1991
Name Of Project: Fermilab Main Injector Project	Federal Agency Involved: Department of Energy
Proposed Land Use: New 150 GeV Proton Accelerator	County And State: Kane County and State of Illinois
PART II *(To be completed by SCS)*	Date Request Received By SCS

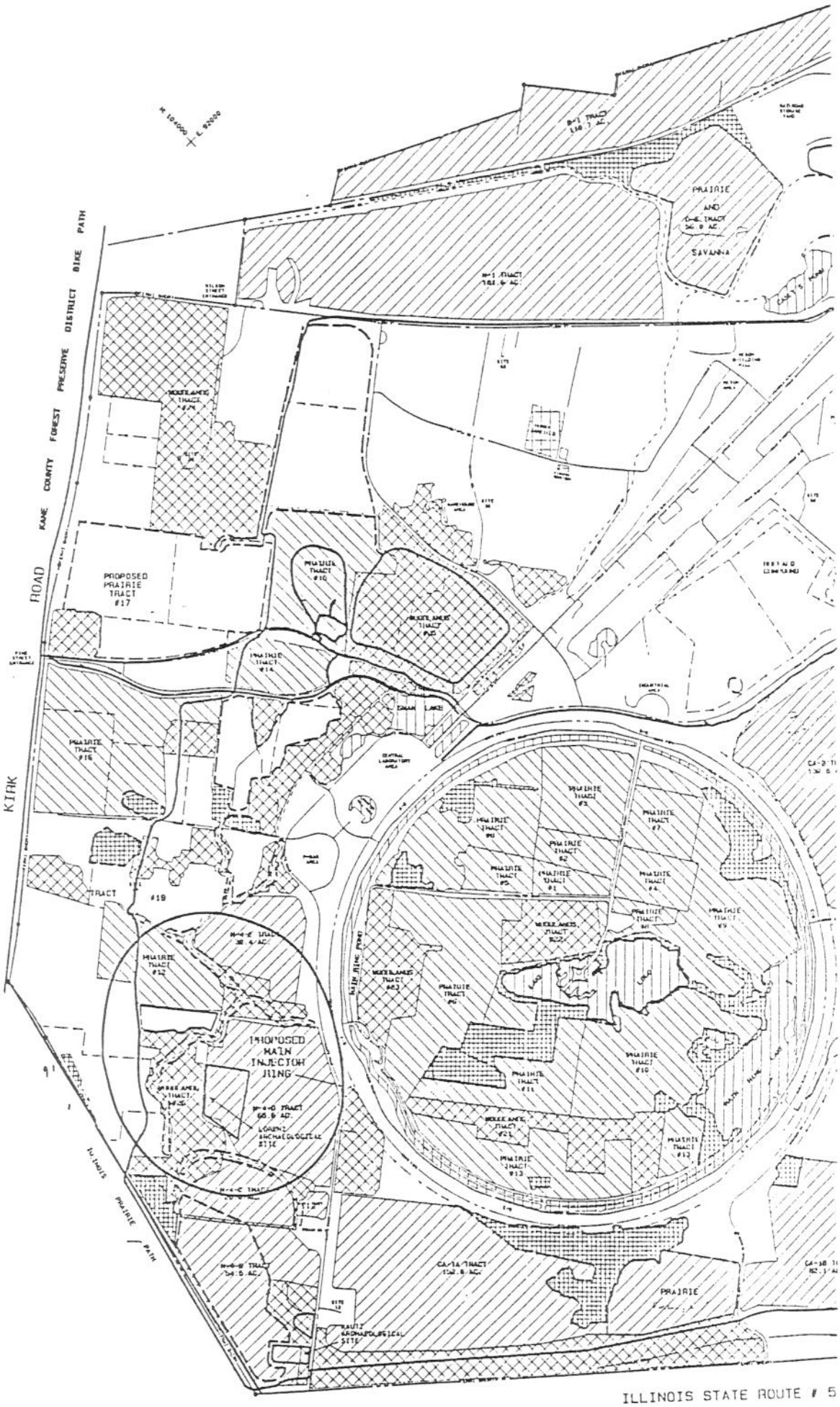
Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply – do not complete additional parts of this form).*	Yes ☐	No ☐	Acres Irrigated	Average Farm Size

Major Crop(s)	Farmable Land In Govt. Jurisdiction: Acres: %	Amount Of Farmland As Defined in FPPA: Acres: %
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By SCS

PART III *(To be completed by Federal Agency)*	Alternative Site Rating: Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	38.5			
B. Total Acres To Be Converted Indirectly	77.5			
C. Total Acres In Site	116.0			
PART IV *(To be completed by SCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value				
PART V *(To be completed by SCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*				
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points			
1. Area In Nonurban Use	15	0		
2. Perimeter In Nonurban Use	10	3		
3. Percent Of Site Being Farmed	20	20		
4. Protection Provided By State And Local Government	20	0		
5. Distance From Urban Builtup Area	15	0		
6. Distance To Urban Support Services	15	10		
7. Size Of Present Farm Unit Compared To Average	10	0		
8. Creation Of Nonfarmable Farmland	10	10		
9. Availability Of Farm Support Services	5	5		
10. On-Farm Investments	20	0		
11. Effects Of Conversion On Farm Support Services	10	0		
12. Compatibility With Existing Agricultural Use	10	0		
TOTAL SITE ASSESSMENT POINTS	160	48		
PART VII *(To be completed by Federal Agency)*				
Relative Value Of Farmland *(From Part V)*	100			
Total Site Assessment *(From Part VI above or a local site assessment)*	160			
TOTAL POINTS *(Total of above 2 lines)*	260			

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:


KANE COUNTY FOREST PRESERVE DISTRICT BIKE PATH
KIRK ROAD
PRAIRIE
SAVANNA
PROPOSED PRAIRIE TRACT #17
PRAIRIE TRACT #16
PRAIRIE TRACT #14
PRAIRIE TRACT #10
PRAIRIE TRACT #12
PRAIRIE TRACT #13
PRAIRIE TRACT #11
PRAIRIE TRACT #9
PRAIRIE TRACT #8
PRAIRIE TRACT #7
PRAIRIE TRACT #6
PRAIRIE TRACT #5
PRAIRIE TRACT #4
PRAIRIE TRACT #3
PRAIRIE TRACT #2
PRAIRIE TRACT #1
PROPOSED MAIN INJECTION RING
MAIN RING ROAD
ILLINOIS PRAIRIE PATH
ILLINOIS STATE ROUTE # 5

United States Department of the Interior

Fish and Wildlife Service
Rock Island Field Office (ES)
1830 Second Avenue, Second Floor
Rock Island, Illinois 61201

COM: 309/793-5800
FTS: 782-5800

TAKE PRIDE IN AMERICA

Batav

In Reply Refer to:

April 30, 1991

Andrew E. Mravca
Area Manager
Department of Energy
Batavia Area Office
P.O. Box 2000
Batavia, Illinois 60510

Dear Mr. Mravca:

This is in response to your letter dated March 28, 1991, regarding a proposed 150 GeV proton synchrotron at Fermi National Accelerator Laboratory in Batavia, Illinois. The project will be located in close proximity to an existing great blue heron colony and will necessitate the filling of 5.7 acres of wetlands. You propose to mitigate any impacts to the rookery and to construct 8.6 acres of wetland.

We have reviewed the information you provided and are convinced that the measures you propose will avoid any impacts to the rookery and negate any loss of wetlands. We must point out, however, that any activity that would cause the herons to abandon their nests, eggs or young is a violation of the Migratory Bird Treaty Act. Your project manager and heron consultant should be aware of this and insure that such disturbance does not occur.

Incidentally, we understand that the herons have abandoned the site for this nesting season and the question of heron disturbance may be moot. This does not guarantee, however, that the birds will not attempt to nest there again next year.

This letter provides comment under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act of 1973, as amended.

Sincerely,

for Richard C. Nelson
Field Supervisor

cc: IDOC (Lutz)
Corps (Rogner)

MAR 2 8 1991

Mr. Gerald Bade
U.S. Department of Interior
Fish and Wildlife Service
Rock Island Field Office
1830 Second Ave., 2nd Floor
Rock Island, Illinois 61201

Dear Mr. Bade:

In reply to your telephone request on March 27, 1991, I am enclosing the documents you mentioned. Included are;

1. Vegetative Survey of the Site Proposed for Building the 150-GeV Main Injector Accelerator at Fermilab, Dr. Robert F. Betz, Northeastern Illinois University.
2. Indian Creek Survey, Envirodyne Engineers.
3. Fishery Survey for Indian Creek in Kane and DuPage Counties, Illinois, Integrated Lakes Management Division, Environmental Products and Services, Inc.

The original ornithologist was Victoria J. Byre of the Chicago Academy of Sciences who has published her studies, i.e., The Birds of Fermi National Accelerator Laboratory. The present consulting ornithologist is Chris Whelan of the Morton Arboretum in Lisle, IL. Perhaps it would help to refer to the newly-completed Environmental Assessment for the Fermilab Main Injector (FMI) Project, i.e., the section on migratory birds:

> 3.8.3.1 Migratory birds. As has been mentioned in the introduction, a great blue heron rookery exists inside the proposed FMI ring in an area that would not be disturbed by the construction of the FMI. The great blue herons are subject to regulation under the federal Migratory Bird Treaty Act, 16 U.S.C. Section 703 et seq. This act prohibits, among other things, the hunting, capturing, killing, or possessing of regulated species.
>
> Great blue herons are decreasing in numbers due to the decrease in a suitable habitat, but are far from qualifying for endangered, threatened, or consideration for protection in the U.S. or Illinois. However, in northern Illinois only a handful of heron rookeries still exist. Because of this, the ornithologist who had been studying their rookery, Victoria J. Byre, was asked to summarize and extend her observations. The heron rookery was discovered in 1985 and grew to approximately 40 nests by 1989. In 1990 it decreased in size to 13 nests, a normal variation and a demonstration of the variability that occurs with great blue heron rookeries. The lifetime of an average heron rookery is 15 years.
>
> The ornithologist has recently relocated to Norman, Oklahoma (September 1990), so a new bird expert, Dr. Chris Whelan, has been asked to review her recommendations, and to assume the follow-on work that is required for the FMI construction to be carried out without a deleterious effect on the great blue heron colony.

4.1.7.1 Migratory birds. As discussed in Section 3.8.3.1, a great blue heron rookery exists inside the proposed FMI in an area that would not be disturbed by FMI construction. To ensure that FMI construction or operation would not adversely affect the heron rookery, an ornithologist was employed to prepare recommendations and precautions for its protection. These recommendations and precautions, which will ensure no violation of the Migratory Bird Treaty Act, are as follows:

1. Proximity of construction activities to the heron rookery will be limited during the heron nesting season. The nesting season is known to vary from year to year; for instance, in 1990 the last nestling was gone by July 12. Construction contracts will include flexible start and stop dates, which will be coordinated with the ornithologist.

2. It should be possible to construct the FMI while adhering to the recommended low noise requirements. Land within approximately 150 meters of the heron rookery has been farmed with the herons in residence, and during June 1990 core drilling took place within 500 meters of nesting herons without disturbance. The latter activity was coordinated with he ornithologist. In 1991, data on noise tolerance levels will be collected using a 1/3-octave band sound-power meter to establish background levels. These data will be used to further define acceptable construction activity noise level.

   A disturbance-free buffer zone would be established following construction of the FMI. The establishment of this zone would be based on sound meter data and would be coordinated with the ornithologist.

3. The clearing through the wooded wetlands at the downstream end of Indian Creek has been reduced to approximately 100 feet wide in accordance with the ornithologist's recommendation. Clearing would be accomplished to the extent practicable by relocating trees into the area between the proposed FMI and the Prairie Path to improve shielding between the path and the heron rookery. In addition, the mitigated wetland adjacent to Indian Creek would have trees planted in order to provide additional protection to the rookery.

4. Water flow, which varies seasonally, in the general area around the heron rookery would be much more controlled after FMI construction than it is now. This will guarantee the best possible conditions for the quality of the site as a heron habitat.

5. Protection of the herons would also provide protection of habitat for numerous other organisms, including insects, amphibians and reptiles, and other bird species and mammals, thereby improving biodiversity of the habitat.

6. An ornithologist would monitor the heron rookery on a regular basis for 5 years to 1) ensure that the FMI operations are consistent with the continued well-being of the heron rookery, 2) determine the number of herons breeding and relative reproductive success, and 3) assess future management options, such as construction of artificial nesting.

7. Very limited access to the center of the FMI after completion of construction would ensure a higher degree of protection of the heron rookery than currently exists, especially protection from vandalism.

Accordingly, construction of the FMI would have no significant impact on the heron rookery or other migratory birds.

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosures:
As stated

MAR 5 1991

Mr. Richard C. Nelson
Field Supervisor
U.S. Fish and Wildlife Service
1830 2nd Ave.
Rock Island, IL 61201

Dear Mr. Nelson:

The U. S. Department of Energy proposes to construct a 150 GeV proton synchrotron, the Fermilab Main Injector at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, IL. Please find enclosed a description of the Fermilab Main Injector project along with the wetlands and floodplains maps.

Pursuant to the Fish and Wildlife Coordination Act, it is our intention to initiate informal consultation with your office and Illinois Department of Conservation before beginning construction of the proposed Main Injector at the Fermi National Accelerator Laboratory in Batavia, Illinois. As you will note in the attached description of the proposed project and the affected environment, the project will temporarily affect the flow of Indian Creek during its construction and require the filling of approximately six acres of wetland. The proposed work is reported in the pending Section 404 Nationwide 26 Joint Permit Application that was submitted to the U.S. Army Corps of Engineers, the Illinois Department of Transportation/Division of Water Resources, and the Illinois Environmental Protection Agency in September 1990.

As you perhaps remember, your office was consulted during the site study for the Illinois site for the Superconducting Super Collider (SSC). At the time areas that would be affected were somewhat uncertain. Now the Fermilab Main Injector project, which only involves a very small portion of the SSC site, is developed to an extent that a more meaningful evaluation can be undertaken.

If you or your staff have any questions or would like to have a tour of the site, please contact Norm Hansen of my staff at (708)840-3281.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosures:
As stated

cc: Mr. John Rogner, w/encl.
Mr. Mark Frech, w/o encl.

AUG 1 1991

Mr. Brent Manning, Director
Illinois Department of Conservation
Lincoln Tower Plaza
524 South Second Street
Springfield, Illinois 62701-1787

Dear Mr. Manning:

SUBJECT: PROPOSED FERMILAB MAIN INJECTOR PROJECT

Thank you for your June 20, 1991, letter responding to my March 5, 1991, request for consultation with your agency pursuant to the Fish and Wildlife Coordination Act regarding the proposed Fermilab Main Injector (FMI) Project.

Before I respond to the specific questions and observations contained in your letter, I thought it appropriate to update you on the status of the heron rookery. As noted in the enclosed letter dated April 30, 1991, from the U.S. Fish & Wildlife Service (USFWS), the heron did not return to the rookery used in 1990, which is inside the proposed FMI construction area. For the 1991 breeding season, the herons are using a nesting site inside the existing Main Ring at Fermilab. This area is about one kilometer from the proposed FMI construction area. The consultant ornithologist, retained to advise the U.S. Department of Energy (DOE) and Fermilab on the precautions necessary to protect the rookery, has determined that because of the distance between the proposed project and the new nesting area, FMI construction and/or operation would not affect the sensitive nesting areas were the herons to return to the Main Ring area in subsequent nesting seasons.

Although the precise cause for the relocation of the heron rookery is unknown, it is possible that the herons were deterred from using the rookery inside the proposed FMI area by a red-tailed hawk. This hawk was observed on several occasions driving off herons as they arrived. Although the hawk also resided near the rookery during the 1990 breeding season, this year the hawk located in the center of that nesting area. It is also possible that the herons found the current nesting site desirable because trees inside the Main Ring have grown to an adequate size and the site is surrounded by a wetland. (The enclosed Figure 3.3.2 from the draft Environmental Assessment for the project, identifies the two rookeries.)

As discussed in the USFWS April 30, 1991, letter, it is possible that the herons could return to the nesting area inside the proposed FMI in future years. Accordingly, DOE and Fermilab have agreed to take a number of precautions to ensure that the construction and operation of the project do not adversely affect that rookery. These precautions are summarized in my letter to Mr. Bade dated March 28, 1991, a copy of which is also enclosed. (The contents of this letter were taken from the draft Environmental Assessment for the project.) As discussed in paragraph 2 of Section 4.1.7.1 of the draft Environmental Assessment, a sound level survey is currently underway to develop background noise levels. This data will be used to further define acceptable construction activity noise levels if the herons return to the nesting area utilized in 1990.

Following is our specific response to the questions and concerns raised in your June 20, 1991 letter:

1. The ornithologists hired to make the recommendations were Victoria J. Byre of the Chicago Academy of Sciences and Dr. Chris Whelan of the Morton Arboretum. I believe that both are well known to your staff; however, if you require more evidence of their qualifications please let me know and I will be glad to send additional material.

2. Item 4.1.7.1 of the draft Environmental Assessment for the project describes the limitations on construction during the heron nesting season if the herons return to the 1990 nesting area. (Included in U.S. FWS letter dated April 30, 1991).

3. This is a valid concern but we feel there are two principal reasons to believe we will be able to ensure the integrity of the heron nesting site. First, as noted previously, the herons have relocated to a site within the Main Ring, far from the proposed construction site. Although it is possible that in future years the herons may move back to the original rookery site, we will be installing artificial nesting platforms at the new rookery site to help ensure that the herons return to this new site., The presence of nesting egrets, and possibly green-backed herons and black-crowned night herons at the new site suggests that our efforts to keep the birds returning to the new rookery site within the ring are likely to succeed. Second, if the birds were to return to the old site, the ornithologist would do periodic observations while construction activity is taking place to assess the effects of the activities on the herons. We believe that only direct observations of the birds can allow us to determine whether our distance requirements for construction are adequate. If the birds appear distressed by any construction activities, new guidelines will be adopted.

4. We plan to relocate trees up to 8 inches in diameter. Any tree above that diameter would be removed if it was directly in the construction area. The new trees would be of modest size since our experience is that larger sizes are slow in establishing themselves.

5. Pursuant to Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (COE) plans to issue a permit authorizing FMI construction in the wetland areas. Recently, the COE inspected the proposed construction site and suggested minor modification to the wetland mitigation plan contained in our Section 404 permit application.

Thank you for your prompt attention to our request for consultation. Should you have any further questions, please do not hesitate to contact me.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosure:
As stated

cc: Mr. Richard Lutz, Ill. Dept. of Conservation, w/encl.
Mr. John G. Rogner, Corps of Engineers, w/o encl.
Mr. Richard C. Nelson, U.S. Dept. of Interior, w/o encl.

bc: J. Peoples, w/o encl.
K. Stanfield, w/o encl.
S. Holmes, w/o encl.
W. Fowler, w/o encl.
D. Cossairt, w/o encl.
W. Hess, ER-20, GTN, w/o encl.
J. O'Fallon, ER-22, GTN, w/o encl.
O. Goktepe, ER-22, GTN, w/encl.
G. Charlton, ER-223, GTN, w/o encl.
J. Farley, ER-8.2, GTN, w/o encl.
C. Hickey, ER-8.2, GTN, w/o encl.
D. Lehman, ER-65, GTN, w/o encl.
D. Goldman, OM, w/o encl.
T. Crawford, AMLM, w/o encl.
S. Silbergleid, OCC, w/o encl.
V. Prouty, OCC, w/o encl.

Illinois Department of Conservation
life and land together

LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787
CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601
MARK FRECH, DIRECTOR KATHY SELKE, ASSISTANT DIRECTOR
BRENT MANNING, DIRECTOR

June 20, 1991

Mr. Andrew E. Mravca
Area Manager
Department of Energy
Batavia Area Office
P.O. Box 2000
Batavia, Illinois 60510

Dear Mr. Mravca:

Reference is made to your letter of March 5, 1991 to former Director Mark Frech concerning your agency's proposed construction of a 150 GeV proton synchrotron at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, Illinois.

The Department's Natural Heritage Database has been reviewed to insure that the proposed activity will not adversely affect Illinois threatened/endangered species or identified natural areas. The following species occurrences have been recorded on the FERMILAB property:

T39N, R9E, Sec.17 - Upland sandpipers were recorded in this area in June and July, 1988.

T39N, R9E, Sec.18 - The threatened sedge Carex atherodes occurs in Machesney Marsh, just outside the FERMILAB property.

T39N, R9E, Sec.30 - Both Carex atherodes and the upland sandpiper have been reported in this section.

T39N, R8E, Sec.24 - A loggerhead shrike nest was recorded in this section in 1989.

T39N, R8E, Sec.36 - The great blue heron rookery discussed in your agency's project description is located in this section. The rookery was first reported in 1985 and contained 12 nests. The number of nests has been increasing, and the most recent report (1989) indicated that 40 nests were present. A brown creeper nest was also recorded in this section, near the rookery, in 1989.

Only the occurrences reported in Section 36 (i.e. the heron rookery and possible brown creeper nests) appear to be in the area that will be directly affected by the injector project. My staff has reviewed the recommendations contained within the project description for protection of the heron rookery during

construction, and we wish to offer the following questions and observations:

1. Section V.3. of the project report indicates that an experienced ornithologist was hired to make recommendations concerning the rookery and other nesting sites in the area. We would appreciate knowing this individual's name and qualifications.

2. Item V.3.a. states that the proximity of construction activity will be "limited" during the heron nesting season and goes on to suggest that there will be a seasonal ban on construction near the rookery. We would like to know more fully what the proposed construction limitations will entail.

3. Item V.3.b. discusses construction activity at various distances from the rookery. We are concerned that human activity in the area near the rookery may be more of a disturbance to the birds than will be indicated by noise level monitoring.

4. Item V.3.c. mentions the removal and "relocation" of trees. Are the trees to be removed small enough that they can actually be relocated, or will they be replaced with new plantings?

5. Item V.3.d. states that water flow in the vicinity of the rookery will be more controlled after construction is complete and that this will ensure habitat quality. However, since the herons have used the rookery for at least six years, the habitat quality may already be optimal for their needs. Is there any assurance that water control will maintain or enhance conditions for the birds?

Great blue herons are, of course, not an endangered or threatened species, but their rookeries are sensitive and important sites. The Department acknowledges the emphasis that has been given to protection of the rookery in your planning efforts to date, and we would welcome the opportunity to discuss the points above with your ornithologist. Careful protection of the rookery should also maintain habitat for the brown creeper.

We appreciate the opportunity to review your agency's plans for the main injector, and we look forward to future coordination regarding both the rookery and wetland mitigation planning. Please contact Richard Lutz of my staff at 217/782-3715 if we may be of further assistance.

Sincerely,

Brent Manning

Brent Manning
Director

BM:RWS:ts
cc: COE (Rogner)
USFWS (Bade)

MAR 5 1991

Mr. Mark Frech
Director
Illinois Department of Conservation
524 South Second Lincoln Tower Plaza
Springfield, IL 62701-1787

Dear Mr. Frech:

The U. S. Department of Energy proposes to construct a 150 GeV proton synchrotron, the Fermilab Main Injector at the Fermi National Accelerator Laboratory (FERMILAB) in Batavia, IL. Please find enclosed a description of the Fermilab Main Injector project along with the wetlands and floodplains maps.

Pursuant to the Fish and Wildlife Coordination Act, it is our intention to initiate informal consultation with your office and the U.S. Fish and Wildlife Service before beginning construction of the proposed Main Injector at the Fermi National Accelerator Laboratory in Batavia, Illinois. As you will note in the attached description of the proposed project and the affected environment, the project will temporarily affect the flow of Indian Creek during its construction and require the filling of approximately six acres of wetland. The proposed work is reported in the pending Section 404 Nationwide 26 Joint Permit Application that was submitted to the U.S. Army Corps of Engineers, the Illinois Department of Transportation/Division of Water Resources, and the Illinois Environmental Protection Agency in September 1990.

As you perhaps remember, your office was consulted during the site study for the Illinois site for the Superconducting Super Collider (SSC). At the time areas that would be affected were somewhat uncertain. Now the Fermilab Main Injector project, which only involves a very small portion of the SSC site, is developed to an extent that a more meaningful evaluation can be undertaken.

If you or your staff have any questions or would like to have a tour of the site, please contact Norm Hansen of my staff at (708)840-3281.

Sincerely,

ORIGINAL SIGNED BY
ANDREW E. MRAVCA

Andrew E. Mravca
Area Manager

Enclosures:
As stated

cc: Mr. John Rogner, w/o encl.
Mr. Richard Nelson, w/o encl.

bc: S. Holmes, Fermilab, w/o encl.
J. Peoples, Fermilab, w/o encl.
D. Theriot, Fermilab, w/o encl.
D. Cossairt, Fermilab, w/o encl.
N. Hansen, BAO, w/o encl.
M. Flannigan, ESHD, w/o encl.
J. Nelsen, ESHD, w/encl.

Department of Energy
Batavia Area Office
Post Office Box 2000
Batavia, Illinois 60510

IHPA REVIEW
H/A
AC
AR Concur 7-19-91
File

JUN 18 1991

RECEIVED
JUN 20 1991
PRESERVATION SERVICES

Mr. William Wheeler
State Historical Preservation Officer
Illinois Historic Preservation Agency
Old State Capitol Building
Springfield, Illinois 62701

Dear Mr. Wheeler:

SUBJECT: 106 DETERMINATION OF NO EFFECT FOR THE FERMILAB MAIN INJECTOR PROJECT SITE

With reference to my letter to your office dated March 15, 1991, same subject, the Department of Energy proposed to construct a 150 GeV proton synchrotron (Main Injector) at Fermi National Accelerator Laboratory (Fermilab). All the proposed project activities will be restricted to approximately 135 acres of the forest and vacant grassland in the south west corner of the Fermilab site.

The Fermilab Main Injector project is in an area where there are three prehistorical sites and five collector finds located within the proposed project area according to the "Report on the Wooded Areas Survey, Gazebo Site Testing, Collector Interviews, and Review of Prehistoric Site Status and Location at Fermi National Accelerator Laboratory" which was prepared by Rochelle Lurie, Midwest Archaeological Research Service, Inc., (MARS, Inc.). This report was submitted to your office on April 23, 1991.

1. Three proposed prehistorical archaeological sites (Tadpole, Lorenz, and Pioneer) have been identified in the vicinity of the construction. As discussed in the March 15, 1991, correspondence to your office, our plan is to leave the sites undisturbed and to exclude them from the compensatory wetland and flood plain areas. The sites will be protected by fencing during construction and the fencing will be removed after construction.

2. Five collector finds (2, 3, 13, 15, and 16) would be impacted by construction.

   Collector find 13 documentation was submitted to your office in 1989. Your office made a determination of ineligibility on November 6, 1989, under Section 106 of the National Historic Preservation Act of 1966.

   Collector find 16 documentation was submitted to your office on March 15, 1991, and your office is currently reviewing the documentation.

   For collector finds 2, 3, and 15, please find documentation of that survey and subsequent testing in the attached report, "Pedestrian Survey of Three Collector Find Locations on Fermi National Accelerator Laboratory, Batavia, Illinois," prepared for

us by consultant archaeologist from MARS, Inc., dated June 4, 1991. Based upon their findings, an Illinois Archaeological Survey (IAS) form has been filed with your office for collector find 15. No new sites were defined in the area of collector finds 2 and 3; and MARS, Inc. recommended no further archaeological work.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulation 36 CFR 800, the Department has determined that the proposed project would have no effect on historical properties listed on or eligible for the NRHP. The DOE plan, for protecting the three potential prehistoric sites, as outlined above; MARS Inc. report on collector find 16 was submitted to your office on March 15, 1991; and the MARS Inc. report on collector finds 2, 3, and 15 is provided for your review and comment.

If you or your staff have any questions, please contact Norm Hansen of my staff (708) 840-3281.

Sincerely,

Andrew E. Mravca
Area Manager

Enclosure:
6/4/91 Report by Midwest Archaeological
Research Services, Inc.

cc: Paula Cross, Staff Archaeologist, w/encl.

CONCUR

By: _____
Deputy State Historic Preservation Officer

Date: July 22 1991

STATE OF ILLINOIS

OFFICE OF THE GOVERNOR

SPRINGFIELD 62706

JIM EDGAR
GOVERNOR

April 24, 1991

Admiral James D. Watkins
Secretary of Energy
1000 Independence Avenue SW
Washington, DC 20585

Dear Secretary Watkins:

The State of Illinois has carefully reviewed the draft "Environmental Assessment" (received March 27, 1991) and the draft "Floodplain/Wetlands Assessment (March 1991 Revision)" for the Proposed Fermilab Upgrade Main Injector Project. Taken together, these documents support the issuance of the "Finding of No Significant Impact" by your department without a full Environmental Impact Statement on the project.

The proposed construction site is one of the most studied areas in the United States. Employees of our state scientific surveys have continuously conducted environmental research at this site since the late sixties, when the original location for Fermilab was chosen. As the SSC site for Illinois, Fermilab has undergone extensive biological, geological, hydrological, social and economic examination which was documented in the Illinois SSC Proposal.

We are confident that through these detailed studies over two decades, we have developed a thorough knowledge of the Fermilab site. As a result, we believe that the Environmental

Assessment has examined all significant environmental issues and is adequate to support a Finding of No Significant Impact in the absence of a full Environmental Impact Statement. We urge you to make such a finding.

Sincerely,

Jim Edgar

Jim Edgar
GOVERNOR

cc: Henson Moore
John Peoples
James F. Decker
Paul L. Ziemer
John S. Moore

APPENDIX B

FERMILAB ADJOINING AND POTENTIALLY AFFECTED PROPERTY OWNERS

APPENDIX B

Fermi National Accelerator Laboratory
Adjoining and Potentially Affected Property Owners

Joseph & Mary Lorenz
719 Batavia Avenue
Batavia, Illinois 60510

Kurt & Debra Harper
45009 Downen Road
Batavia, Illinois 60510

LaSalle National Bank
Trust #10-22780-09
135 S. LaSalle Street
Chicago, Illinois 60603

Dale & Carolyn McBride
1308 Cherry Drive
Batavia, Illinois 60510

Robert & Jasmina Sheehan
1300 Cherry Drive
Batavia, Illinois 60510

Keith & Nancy Getz
1248 Hillsboro Drive
Batavia, Illinois 60510

Michael & Laurie O'Neill
1234 Hillsboro
Batavia, Illinois 60510

John & Laura Carr
1218 Hillsboro Drive
Batavia, Illinois 60510

Joseph & Margaret Fidler
R.F.D. #2
Maple Park, Illinois 60151

Patrick Conroy
33W991 Butterfield Road
Batavia, Illinois 60151

Amoco Oil Company
P.O.Box 3428
Oak Brook, Illinois 60521

Michael & Bridget Carper
1232 Giese Road
Batavia, Illinois 60510

American National Bank of
Lansing - Trust #2040-386
3115 Ridge Road
Lansing, Illinois 60438

John & Anna Roth
35015 Wagner Road
Batavia, Illinois 60510

Jonathan Wenberg
218 Hamlet Street
Batavia, Illinois 60510

Aurora National Bank #980
2 South Broadway
Aurora, Illinois 60807

Arthur & Diane Blodgett
1312 Cherry Drive
Batavia, Illinois 60510

Jack & Julie Welbourne
1304 Cherry Drive
Batavia, Illinois 60510

Michael & Diane Jones
1256 Hillsboro Drive
Batavia, Illinois 60510

Michael & Donna Thurow
1242 Hillsboro Drive
Batavia, Illinois 60510

Brian & Margaret Creed
1226 Hillsboro Drive
Batavia, Illinois 60510

Russ & Cathy Martin
34W024 Butterfield Road
Batavia, Illinois 60510

Bert & Florine Martin
34W005 Butterfield Road
Batavia, Illinois 60161

William & Mary Collins
2 Wildwood Drive
Oswego, Illinois 60543

Bill & Barbara Hepola
1308 Giese Road
Batavia, Illinois 60510

Joseph & Phyllis Tolian
1224 Giese Road
Batavia, Illinois 60510

Aurora National Bank Trust #1219
2 South Broadway
Aurora, Illinois 60507

Butterfield Freewill Baptist Church
P.O.Box 981
Aurora, Illinois 60507

George & Gloria Wilmes
1382 Garden Court
Batavia, Illinois 60410

State Bank of Countryside #89-527
6724 Joliet Road
Countryside, Illinois 60425

Kane County Forest Preserve
719 Batavia Avenue
Geneva, Illinois 60134

Continental Homes of Chicago, Inc.
Batavia, Illinois 60510

First National Bank of Batavia
Trust #672
1348 Giese Road
Batavia, Illinois 60510

Lenz & Lisa Bradley
1340 Giese Road
Batavia, Illinois 60510

Ronald & Carolyn Knapik
1332 Giese Road
Batavia, Illinois 60510

Robert & Patricia McNamara
1324 Giese Road
Batavia, Illinois 60510

Robert & Lianne O'Keefe
1316 Giese Road
Batavia, Illinois 60510

Sammy & Kari Goe
1240 Giese Road
Batavia, Illinois 60510

Robert & John Dante
128 Woodland Hills Road
Batavia, Illinois 60510

This is a list of the property owners, in the vicinity of the project area, that border Fermilab property. The adjoining property owner list was determined by Sidwell Plat Maps and PIN numbers. The plat maps are available at the Tax Assessor's Office, Batavia, Illinois.

APPENDIX C

MITIGATION ACTION PLAN

(MAP)

1.0 INTRODUCTION

1.1 Purpose of the Mitigation Action Plan (MAP) for the Fermilab Main Injector (FMI)

In February 1990, the Secretary of Energy issued Notice 15-90 (SEN-15). The intent of SEN-15 is to strengthen the National Environmental Policy Act (NEPA) process within the U.S. Department of Energy (DOE). One of its new requirements is that a MAP must be prepared for any Environmental Assessment (EA) whose Finding of No Significant Impact (FONSI) was predicated on the use of mitigative actions.

As indicated in SEN-15, the MAP is essentially an internal DOE management document. It has three major purposes:

1. To catalog the mitigation as indicated in the EA upon which the mitigated FONSI was predicated;

2. To specify responsibility for the actions that will be taken to mitigate the consequences cataloged; and

3. To describe the process to be employed to ensure implementation of the required actions by the appropriate parties.

The DOE has overall responsibility to see that the environmental consequences assessed in the EA are mitigated as specified. The DOE will meet its responsibility for development and documentation of the mitigations through the appropriate parties, depending upon the particular environmental topic area and the specific mitigation action in question. For the purposes of this MAP, these responsible parties are as follows:

DOE: The Batavia Area Office-Chicago; Office of Chief Council-Chicago; Environment, Safety and Health Division-Chicago; Energy Research-8; Environment, Safety and Health-25;

Fermilab: The Fermilab Management and Operating contractor--Universities Research Association (URA); and

Fluor-Daniel, Inc.: The Architect-Engineer (A/E) entity contracted to undertake conventional facility design.

In this MAP, the responsibilities of these parties are set forth in a primary responsibility matrix. There are four areas of responsibility identified in this matrix. They are defined below.

Mitigation Development--the design of the mitigative action, which includes the what, how, when, and where of the mitigative action to be taken. The design of the mitigative action will be furnished to the A/E for incorporation into Title 2 drawing, specification, and contract documents. The Title 2 review will insure compliance with these requirements.

Mitigation Implementation--the actual implementation of the mitigative action. The party with primary responsibility here is the one who has control over the project design and implementation.

Mitigation Monitoring, Implementation and Reporting--the act of ensuring and reporting that a mitigative action was in fact accomplished in accordance with the mitigation plan. This includes the collection of activities that will be conducted to determine if the mitigative action is performing as intended (i.e., is it producing the desired results or level of environmental impact mitigation) and, if it is not, to help in determining what alternative actions should be taken.

Fermilab will utilize the annual Fermilab Site Environmental Report (SER), prepared in response to the requirements of DOE Order 5440.1D 6.A(21), as the principal vehicle for reporting progress made in implementing the provisions of the MAP. The SER will summarize information on all mitigative actions taken during the reporting period it covers, describe the environmental monitoring data collected, and summarize the mitigative actions projected to be implemented during the next reporting period. Thus, all of the responsible parties mentioned above will be asked to provide contributions to the SER. Any separate mitigation action report requested by DOE would be prepared by Fermilab on an *ad hoc* basis.

The environmental consequences projected in the EA were based upon modelling and environmental assessments. While these efforts can predict potential consequences, monitoring is necessary to validate the extent and degree of an environmental consequence requiring mitigation. Therefore, monitoring forms the framework upon which mitigative action for any environmental consequence areas is based. The monitoring efforts will be designed to answer the following questions:

1. Is the FMI project creating negative environmental consequences that were not projected in the EA or the FONSI?

2. Is the mitigative action indicated in the EA and the FONSI the most appropriate action to implement? If not, a revised action will be developed.

3. Have previously identified and validated mitigative actions been implemented? If not, the reason why will be determined and corrective action taken.

4. Have implemented mitigative actions produced the desired results? If not, revisions thereto will be adopted to produce the required mitigation.

Mitigation Verification and Performance Auditing--the act of auditing all aspects of a mitigative action to ascertain the state of compliance with requirements and to ensure that DOE commitments are honored.

1.2 Related Documents

It should be pointed out that some mitigative actions are not fully addressed in the MAP because they have already been accomplished. An example is the change in the design of the project to minimize the area of wetland that would be altered as described in both the EA and the Floodplain/Wetland Assessment. Since this action as well as other already accomplished tasks are described in the EA and Floodplain/Wetland Assessment, they are not repeated here in detail.

In April 1990 Fermilab issued Revision 2.3 of the FMI Conceptual Design Report (FMI-CDR Rev. 2.3). The FMI-CDR Rev. 2.3 is the baseline document for the design characteristics of the machine and its support facilities. In March 1991 an addendum was issued which updated the CDR to serve as the basis for conventional facility designs to be carried out by the A/E firm of Fluor-Daniel.

In June 1991, the U.S. Army Corps of Engineers (COE) issued an authorization pursuant to Section 404 of the Clean Water Act for FMI construction in wetland areas. Pursuant to Special Condition 4 of the nationwide 26 authorization, a mitigation plan, including an implementation plan and schedule of completion, a re-vegetation plan, a five year management and monitoring plan, a detailed grading plan and an erosion control plan will be submitted to the COE for approval prior to construction.

This MAP provides the basis for translating the environmental actions analyzed in the EA and the FONSI into specific mitigative actions. Details of actions as applied to actual field and design conditions will be specified in the Title 2 design document.

2.0 THE PROPOSED ACTION AS RELATED TO MITIGATIONS

The resources of concern during FMI construction are the floodplain of Indian Creek, the wetlands adjacent to that creek, and migratory birds.

2.1 Floodplain of Indian Creek (EA Sections 2.1.4, 3.8.1 and 4.1.3.1)

The EA and Floodplain/Wetland Assessment detail the actions that will be undertaken to minimize the disturbance to the Indian Creek watershed. During FMI construction, Indian Creek will be temporarily diverted to keep construction areas dry. Normal water levels will be restored when construction work in the Indian Creek area is completed.

Compensatory storage calculations indicate that 29 acre-feet of storage is needed to compensate for the construction of the FMI within the floodplain. This storage will be provided on 12 acres within the FMI, which would be completed during the initial phases of FMI construction. Most of the flows associated with a storm larger than a 10-year storm event will be diverted around the FMI into and through the northern and southern cooling ponds using a passive overflow system. Thus, the cooling ponds will provide a temporary retention of the large flows. The remainder of the flood flow will be routed to the FMI infield to maintain normal flows and retention conditions. Because the floodplain mitigation area will be completed during the initial phases of construction, there will be no reduction in the retention capacity of the Indian Creek drainage basin.

The EA and Floodplain/Wetland Assessment outline the engineering studies that were performed to prevent any detrimental effects to upstream and downstream areas and to ensure that the existing 100-year flow of Indian Creek will be maintained.

2.2 Wetlands (EA Sections 3.8.3 and 4.1.3.2)

The mitigation plan for the wetlands that will be affected by FMI construction complies with the requirements of NEPA and Section 404 of the Clean Water Act. As discussed in more detail in the EA and Floodplain/Wetland Assessment, the mitigation plan includes avoidance of alterations, minimization of alterations, rectification of alterations, and compensation for the disturbances through replacement.

The total amount of wetlands impacted by direct fill activities will be approximately 7.14 acres. Of these 7.14 acres, 1.14 acres will be excavated to accommodate cooling pond designs. Another 0.30 acres will be temporary fill so the total direct fill activities will impact approximately 5.70 acres. The mitigation design incorporates 8.60 new acres of wetland. This proposed mitigation ratio is more than 1.5 to 1.0.

The mitigation concept incorporates the existing soil and hydrology characteristics in the selection of the proposed mitigation site. The proposed mitigation site is a recently farmed area that supports hydric soils. This area has water and available seed source. The area will be graded to match the grade of the adjacent wetland to ensure sufficient hydrology is obtained for wetland establishment and success.

The soil removed from the disturbed wetlands would be utilized in the mitigation area and thus provide a soil seedbank for the created wetland area. At the request of the COE, the mitigation area will consist of approximately 2.30 acres of interspersed sedge communities and the remainder of the area, 6.30 acres, will have some planting of 6' - 8' tall saplings, consisting of silver maple, Acer saccharinum, and other species such as box elder, Acer negundo, and green ash, Fraxinus americana, that are found in surrounding wetlands. These trees will be transplanted from impacted areas or bought in order to accelerate the revegetation of the mitigation area. The plants of the sedge meadow areas will include swamp sedge, Carex muskingumensis, which is currently found at the Fermilab site. Other commercially available sedges that are native to Kane County and inhabit sedge meadows to floodplain forests that may be planted include the following species: Carex stipata, Carex convoluta, Carex cristartella, Carex rosea, and Carex grayii. Some blue flag iris, Iris virginica shrevei and river bulrush, Scirpus fluviatilis also may be planted near the stream.

A detailed plan will be submitted to the COE concurrent with the final construction documents. Any appropriate comments or recommendations of the Illinois Department of Transportation/Division of Water Resources (IDOT/DWR) in connection with its final review of the Section 404 permit will be coordinated with DOE and Fermilab, and incorporated by the A/E into the final mitigation plan.

The management of the wetland mitigation site will include the replanting of unsuccessful areas and removal of all litter and debris from the site. A snowfence will be placed around the mitigation area immediately after the planting/seeding of the area to deter human and animal disturbance during the most sensitive period of establishment. Additionally, proper erosion practices will be followed throughout the entire construction phase of the project.

The subject wetland will primarily be managed for species diversity and wildlife value. Volunteer cattail (Typha spp.) will be removed manually from the wetland. Purple loosestrife (Lythrum salicaria) and other aggressive nuisance species will be controlled by application of specific chemicals or manual removal. The use of herbicides will be avoided to the greatest extent possible but may be used if other control measures are unsuccessful. To further discourage Typha spp. growth and other undesirable species the placement of fertilizer in or near the wetlands will be avoided to the greatest extent possible. For the trees planted, fertilizer spikes will be used. Additionally, only plugs will be placed and natural re-vegetation will occur to avoid any contamination from seed mixtures that can contain unwanted nuisance species.

The wetland mitigation site, located on the laboratory property, will be monitored for a period of five years as prescribed in special permit condition number 4 of the Section

404 permit. The monitoring program will entail specific floristic and avi-fauna studies as detailed in the Wetland Monitoring Plan. Management objectives will be determined from the conclusions of wetland monitoring results. Monitoring activities are scheduled to occur the first, third and fifth years following the seeding and planting of the area. The preliminary performance criteria for the mitigation site will be 60% surface cover by the second year and 75% cover after three years.

The overall beneficial values and the quality of the existing wetlands will not be significantly affected by construction of the proposed project and the direct fill of 5.70 acres because of the mitigative measures taken. Over time the mitigation should compensate for any significant loss of wetland function due to direct fill.

Disturbances to the wetland areas were further minimized by the drainage structures designed to pass water through and under the shielding berms, road beds, and ponds. These structures will maintain the normal surface water flow through the interior of the FMI.

When construction is conducted in sensitive wetland areas, the wetland disturbance will be minimized by maintaining construction equipment on floating mats, thereby reducing the amount of soil compaction. Temporary wetland disturbances due to increased erosion, sedimentation, and turbidity from construction activities will be minimized by implementing a soil erosion control plan. To further lessen the vegetation disturbances, clearing for construction purposes will be restricted to only essential clearings.

Wetland areas disturbed by construction activities but not directly filled will be revegetated as soon as practicable and new vegetation will be monitored. Areas of temporary fill, for construction purposes, will be excavated to the original grade and restored to preconstruction condition. DOE will maintain the existing watershed characteristics within the project site and the surrounding areas. These actions should rectify any temporary wetland disturbances.

2.3 Migratory Birds (EA Section 4.1.7.1)

A great blue heron rookery was discovered in 1985 in an area inside the proposed FMI ring. Herons are protected under the Migratory Bird Treaty Act, which prohibits actions that could harm birds, eggs, or young. In 1991, the herons nested near the center of the Main Ring. If the herons return to the area inside the Main Ring, there would be no restriction on FMI construction inasmuch as the herons would be at least 1.0 km from the construction site and would not be located in any sensitive areas. Although the herons failed to return to the area inside the proposed FMI ring in 1991, precautions will be taken so that the nesting herons would not be driven away by noise or other effects of FMI construction or operation in the event herons would use the area as a rookery during FMI construction or operation.

The rookery area will be protected from construction equipment, and the trees that served as the nesting sites for the heron will be preserved. To ensure that FMI construction or operation would not adversely affect the heron rookery, an ornithologist was employed to prepare recommendations and precautions for its protection. These recommendations and precautions, which will ensure no violation of the Migratory Bird Treaty Act, are as follows:

1. DOE will limit proximity of construction activities to the heron rookery during the heron nesting season. The nesting season is known to vary from year to year, for

instance in 1990 the last nestling was gone by July 12. Construction contracts will include flexible start and stop dates, which will be coordinated with the ornithologist.

2. The heron rookery would also be protected from excessive construction related noise impacts. It should be possible to construct the FMI while adhering to the recommended low noise requirements. Land within approximately 150 meters of the heron rookery has been farmed with the heron in residence, and during June 1990 core drilling took place within 500 meters of the nesting heron without disturbance. The latter activity was coordinated with the ornithologist. Temporary construction noise impacts to wetland fauna, especially the great blue heron, would be minimized by restricting or prohibiting construction in certain areas near the heron rookery during the nesting season, and the use of proper muffler systems on the construction equipment. In 1991, data on noise tolerance levels will be collected using a 1/3 octave-band sound-power meter to establish background levels. This data will be used to further define acceptable construction activity noise level.

   DOE will establish a disturbance-free buffer zone following construction of the FMI. The establishment of this zone would be based on sound meter data and would be coordinated with the ornithologist.

3. The clearing through the wooded wetlands at the downstream end of Indian Creek has been reduced to approximately 125' wide in response to the ornithologist's recommendation. Clearing would be accomplished to the extent practicable by relocating trees into the area between the proposed FMI and the Prairie Path to improve the shielding between the path and the heron rookery. In addition, the mitigated wetland adjacent to Indian Creek would have trees planted in order to provide additional protection to the heron rookery.

4. The water flow through the heron rookery would also be maintained to avoid any changes in the existing characteristics of the areas. The water flow, which varies seasonally, in the general area around the heron rookery would be much more controlled after FMI construction than it is now. This will ensure the best possible conditions for the quality of the site as heron habitat. Construction will also coincide with low flows to insure minimal impact on the benthic fauna and fish.

5. Protection of the heron would also provide protection of habitat for numerous other organisms, including insects, amphibians and reptiles, other bird species and mammals, thereby improving biodiversity of the habitat.

   Construction of the FMI and associated structures would help to improve the biodiversity of the area in two principal ways. First, the great blue heron rookery site inside the proposed FMI ring (no longer currently in use because the birds moved to a new location within the Main Ring) exists on property that appears to have been flooded some time in the comparatively recent past. Because of the water-logged soils, many trees have already died, and many more may do so in the future. Even though the construction plans for the FMI include passive water level control, it would also be possible to control water levels thereby increasing the longevity of the trees in the site. Thus, the plant species negatively affected by the flooding and water-logged soils would have the opportunity to increase in population size or to recolonize the area (either through the seedbank or from dispersal from nearby sites). And concomitantly, the various animals, including

both invertebrates and vertebrates, that use these plant species should benefit as well.

Second, while the Fermilab property is kept under close inspection by security personnel, nonetheless, from time to time, problems with poachers and other (more benign) intruders have been experienced. The impact of such intrusions on the bio-diversity of the area is impossible to quantify precisely, but it can be assumed that such intrusions have a negative rather than a positive effect. Construction of the injector ring will increase the security of this site, reducing all intrusions into the area virtually none. This greater security will have positive effects on the bio-diversity of the site.

6. An ornithologist would monitor the heron rookery on a regular basis for 5 years to a) ensure that the FMI operations are consistent with the continued well-being of the heron rookery, b) determine number of herons breeding and relative reproductive success, and c) assess future management options, such as construction of artificial nests.

7. Very limited access to the center of the FMI after completion of construction will assure a higher degree of protection for the heron rookery than currently exists, especially protection from vandalism and poachers.

FMI CONSTRUCTION ACTIVITIES AS RELATED TO MITIGATIONS
PRIMARY RESPONSIBILITY MATRIX*

Mitigation Action	Mitigation Development	Mitigation Implementation	Mitigation Monitoring, Implementation & Reporting	Mitigation Verification & Performance Audit
2.1 Floodplain of Indian Creek	A/E	Fermilab	Fermilab IDOT/DWR	DOE CH-BAO; EH-24; ER-22
2.2 Wetlands	A/E	Fermilab	Fermilab U.S. COE	DOE CH-BAO; EH-24; ER-22
2.3 Migratory Birds	A/E	Fermilab	Fermilab Ornithologist	DOE CH-BAO; EH-24; ER-22

*Schedule under development.